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ENGINEER DEPARTMENT, UNITED STATES ARMY.

PRELIMINARY REPORT
OF
EXPLORATIONS
IN
NEBRASKA AND DAKOTA,
IN THE
YEARS 1855-'56-'57,

BY
LIEUT. G. K. WARREN, TOPOGRAPHICAL ENGINEERS, U. S. ARMY,

[NOW MAJOR OF ENGINEERS, AND BVT. MAJOR GENERAL, U. S. A.]

REPRINT.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1875.

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NOTE—This report was originally printed in the appendixes to the Report of the Secretary of War, in the President's Message and Documents, December, 1858.

The map was printed by resolution of the United States Senate.

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OFFICE OF THE CHIEF OF ENGINEERS,
Washington, D. C., August 18, 1875.

SIR: In 1857 an exploration of the Black Hills was made by Lieut. G. K. Warren, Topographical Engineers, (now major of engineers, and brevet major-general United States Army.)

A preliminary report of this exploration (embracing also his explorations in Nebraska and Dakota for the two previous years, 1855-'56) was appended to my annual report, as captain of Topographical Engineers in charge of office of explorations and surveys for the War Department, for the year 1858.

As this report was printed with the documents accompanying the President's annual message to Congress in December 1858, (in the annual report of the Secretary of War,) it can always be referred to for official purposes, but is not accessible to those specially interested in the region of which it treats.

Recent developments in the Black Hills country have awakened a great interest in that region, and there are constant inquiries for the report referred to.

I would therefore recommend that this report be reprinted at the Government Printing-Office, and that 2,000 copies be furnished to this Office, upon the usual requisition.

Very respectfully, your obedient servant,

A. A. HUMPHREYS,
Brigadier-General and Chief of Engineers.

Hon. WM. W. BELKNAP,
Secretary of War.

Approved by order of the Secretary of War.

H. T. CROSBY,
Chief Clerk.

AUGUST 20, 1875.

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[EXTRACT FROM THE ANNUAL REPORT OF CAPTAIN A. A. HUMPHREYS
TOPOGRAPHICAL ENGINEERS, IN CHARGE OF EXPLORATIONS AND SUR-
VEYS, TO THE SECRETARY OF WAR.]

WAR DEPARTMENT, OFFICE EXPLORATIONS AND SURVEYS,
Washington, November 20, 1858.

* * * * *

EXPLORATIONS IN NEBRASKA.

The return in November last of the expedition commanded by Lieut. G. K. Warren, Topographical Engineers, after the successful execution of the duties intrusted to him of reconnaissance and exploration in Nebraska, has been already reported. The maps have been completed, all the necessary calculations of the astronomical and barometrical observations made, and the reports in relation to the different objects of the expedition are in an advanced state.

The principal objects of the expedition were to ascertain the best route by which to continue to the South Pass the military road now constructing from the Mississippi River to Sioux City, on the Missouri, and to examine in this connection the valley of the Loup Fork of the Platte, and that of the Niobrara, and to make such reconnaissance of the Black Hills, about the sources of the Big Cheyenne, as circumstances would permit, to determine their character, especially with reference to the future military operations that may be carried on in this Territory. In accomplishing these objects, the expedition would obtain information of the character and resources of the country, its adaptability to settlement and cultivation, and would develop its geography and geology along the routes pursued, nearly all of which were previously unexplored by white men.

The preliminary report of Lieutenant Warren is herewith presented. The routes reconnoitered and mapped in 1857 are from Sioux City to the mouth of Loup Fork; thence up this stream to its source in the Sand Hills; and thence by the Niobrara to Fort Laramie. From this point the party proceeded north, and carefully examined the Black Hills, and, returning to the Niobrara, explored this stream to its junction with the Missouri; and also a route from the mouth of Turtle Hill River to Fort Randall. Finally, the road from Fort Randall to Sioux City was surveyed.

With the report on these routes Lieutenant Warren combines that of the routes examined by him in 1856, under orders from General Harney, of which examinations no report has heretofore been presented.

In that year he made a careful reconnaissance of the Missouri River, from the southern boundary of Nebraska to a point sixty miles above the mouth of the Yellowstone, and of this latter stream to Powder River.

The routes explored, including those of 1858, (of which a report has been rendered and printed,) all lie east of the 106th meridian. They lead once through the Sand Hills north and south, and twice east and west, almost around the Black Hills, and through the valleys of the following rivers, viz: the Platte, Loup Fork, Niobrara, White Earth, Big Cheyenne, Missouri, Yellowstone, and James rivers.

The accompanying report of Lieutenant Warren is divided as follows:

Part 1 is a statement of the routes pursued and main incidents which affected their direction and extent; and in connection with this are given the objections urged by the Dakotas against the passage of the expedition through the Territory. This may prove valuable to any white men that may travel there.

Part 2 contains a general description of the surface of Nebraska; an account of the general structure of the country; its principal geological formations and the character of the soil; and its adaptability in different parts to settlement.

It confirms the statements heretofore made by explorers in other portions of the western prairies of the generally sterile character of the lands west of the 99th meridian, attributable to the absence of fertile elements in the soil in large tracts like the Sand Hill region, and to the want of timely rains.

The section in the mountains bordering these plains on the west is described as containing small fertile valleys, with streams of water and an abundance of building material, both of stone and wood, and an ample supply of the latter for fuel. The opinion is expressed that this section will be overspread by considerable settlements.

Part 3 contains a general description of the rivers and routes through the Territory, with a discussion of the question as to the best route by which to supply Fort Laramie and the interior. The conclusions arrived at in regard to this last question are, that the route up the Loup Fork is impracticable, and, besides, is less direct than the Platte route; that the route along the Niobrara is barely practicable for wagons, and that the difficulties to be met with on the road, together with the increased river transportation of the route, render it less favorable than that up the Platte, whether the starting-point be Omaha City or Nebraska City; that a road from Sioux City to Fort Laramie, along the Niobrara, would only be about forty miles shorter than a road proceeding from the same point direct to the Platte, at the mouth of Loup Fork, and thence along the Platte route to Fort Laramie; that the shorter length of the Niobrara route is more than counterbalanced by the great difficulties on that route, and therefore the route along the Platte is the better of the two; that the route from the mouth of White River west to Fort Laramie is probably practicable, and superior to that along the Niobrara; that the route from Fort Pierre to Fort Laramie is likewise superior to the Niobrara route, but that the increased river transportation and absence of settlements along this part of the Missouri River render these routes at present inferior to those of the Platte Valley; that above Fort Pierre, on the navigable part of the Missouri River, there are no routes leading from it to Fort Laramie or the South Pass that are as advantageous as those enumerated. It is further concluded that, of all the routes explored, the Platte Valley is the best adapted for locating a railroad to connect the settlements to be formed in the mountains with those along the Missouri River; and that, as a national route for a Pacific railroad, leading to the South Pass or to Bridger's Pass, it is superior to any other in this latitude. These conclusions appear to be fully sustained by the facts advanced in their support.

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The 4th part of the report treats of the Indian tribes, their number, location, &c. An approximate estimate of their strength is made, and routes by which to operate against them, in the event of hostilities, are discussed. Almost every part of the country examined is practicable for the operations of cavalry; and routes practicable for the wagons of a military expedition can generally be found, even in the Black Hills, to such points as would be used as depots from which supplies for brief periods could be furnished for military movements.

The 5th part of Lieutenant Warren's report is a brief statement of the meteorological phenomena of the country, as observed during the explorations; the most prominent facts respecting which are the extreme variableness of the phenomena of moisture and temperature—facts which confirm previous statements in regard to them.

The report contains a catalogue of the fossils collected, with the localities of the specimens, and similar lists of the plants and the collections in the different departments of zoology. All these collections were made without interfering with the more immediate practical objects of the explorations, and reflect credit on the labors of Lieutenant Warren and his assistants. These collections are esteemed to be of high scientific value; and among the discoveries due to the labors of the expedition are the discovery of the Potsdam sandstone, the oldest of the fossiliferous rocks in the Black Hills, the first positive proof of the existence in America of the formation corresponding to the Jurassic of Europe, and the discovery on the Niobrara of a new formation of the Pliocene Tertiary, containing the remains of an extinct fauna resembling that now inhabiting Asia, from which at least thirty-two distinct species of vertebrates have been described by Professor Leidy. The principal of these results have been published, by permission of the Department, in the proceedings of the Academy of Natural Sciences of Philadelphia. Accompanying one of these papers, prepared by Dr. Hayden, is a small geological map of Nebraska.

A military map of Nebraska and Dakota, on a scale of $\frac{1}{1200000}$, prepared by Lieutenant Warren, and ordered to be engraved by the Senate at its last session, is now ready for publication.

The completion of the exploration of the interior of Nebraska, about the sources of the Yellowstone, Lieutenant Warren thinks could be most advantageously and economically made by an expedition organized to remain at least two years in the field, and the cost of this he estimates at \$60,000. This exploration has been a favorite object with him, and his previous experience, and his knowledge of the Indians and character of the country, would enable him to accomplish the work with economy.

The highly creditable manner in which the explorations heretofore intrusted to him have been conducted, under many embarrassments, difficulties, and dangers, prove him to be peculiarly well qualified for the task.

A detailed plan for the execution of the work will be found in the report.

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EXPLORATIONS IN NEBRASKA AND DAKOTA.

PRELIMINARY REPORT OF LIEUT. G. K. WARREN, TOPOGRAPHICAL ENGINEERS, TO CAPT. A. A. HUMPHREYS, TOPOGRAPHICAL ENGINEERS, IN CHARGE OF OFFICE OF EXPLORATIONS AND SURVEYS, WAR DEPARTMENT.

WASHINGTON, D. C., *November 24, 1858.*

CAPTAIN: I have the honor to submit the following preliminary report on the results of the explorations conducted by me in Nebraska in the years 1855, '56, '57. This report is divided as follows:

1st. Routes explored, and main incidents affecting their direction and extent;

2d. Physical geography of Nebraska, character of the soil, and resources of the country;

3d. Remarks upon the climate and meteorology;

4th. A description of the principal rivers, and discussion of the merits of different routes; and

5th. An enumeration of the Indian tribes, military posts, and routes for military operations.

To the report is annexed a small map of Nebraska on a scale of 1 to 6,000,000, showing the main physical features of the country and the routes requiring further examination, as well as those already explored. The report is accompanied by catalogues of the paleontological, mineralogical, botanical, and zoological specimens collected on our explorations, prepared by Dr. F. V. Hayden, so as to show the localities where they were found. Much useful instruction as to the manner of making meteorological observations and collecting specimens in natural history was given to us by the officers of the Smithsonian Institution, and the Secretary, Professor Henry, furnished us with rooms in which to store the collections and elaborate the results. A brief report, by Dr. Samuel Moffitt, of the health of the party during the expedition in 1857, is also appended.

We have found it necessary to defer to a subsequent report the narrative and itinerary of the routes, the complete maps, profiles, and other illustrations, the tables of meteorological observations, and the results of our collections and observations in geology, botany, &c.

Some of the geological results have already been published by permission of the War Department in papers read by Dr. Hayden, Mr. F. B. Meek, and Dr. Joseph Leidy, before the Academy of Natural Sciences of Philadelphia. A letter prepared by me for the Hon. G. W. Jones, Senator from Iowa, has also been published, accompanied by a small map of Nebraska, on a scale of 1 to 6,000,000. This map has also been colored so as to indicate approximately the geological formations, and in this shape is published with one of the papers prepared by Dr. Hayden in the Proceedings of the Academy of Natural Sciences of Philadelphia.

A map of my explorations in Nebraska was ordered to be engraved, by the United States Senate, during the last session, and is now nearly ready for publication. In preparing this map I availed myself of all other explorations and surveys within the limits comprised by it, (in-

cluding thus some late unpublished maps kindly furnished from the Interior Department,) an acknowledgment of all of which is made thereon. It was necessary to indicate on this map a considerable portion of the country not examined by me in order to give it the greatest practical value, and to show the relation of the parts I have explored to those surrounding them. My design was to make the map a complete representation of all the region occupied by the Dakotas, and the best routes by which to approach and traverse it, and along which to conduct military operations to the best advantage; in other words, to make it a "Military Map of Nebraska and Dakota," which is the title I have given it. It is on a scale of 1 to 1,200,000, and embraces all the country from the 94th to the 106th meridian, between the 38th and 50th parallels. In its northeast corner is the Lake of the Woods, in the southeast Fort Leavenworth, in the southwest Pike's Peak, and in the northwest the junction of Milk River with the Missouri. A number of rivers are put down on this map which have never yet been explored, except at their mouths; these are the Knife River, Heart River, Cannon Ball River, and Moreau River. As the expeditions under my command have gone almost around the section through which they flow, and determined with a great degree of certainty that it is an open prairie, and have gained some knowledge of their lengths and directions from the Indians, they are probably represented with a considerable degree of exactness.

On the small map accompanying this report the southern branches of the Yellowstone River have also been represented with an approximation to correctness, by using information furnished by the expeditions of Captains Lewis and Clark, and Captain Bonneville, and also from sketches, &c., obtained by me from traders and trappers. This section of country, however, has much practical importance in relation to routes through it by which to reach Utah from the navigable parts of the Missouri and Yellowstone, and deserves a thorough exploration. This examination I have always had a great desire to make, and in my previous expeditions have taken much pains to ascertain the best means of conducting it. In this I have been fortunate in meeting with Mr. James Bridger, Mr. Alexander Culbertson, Mr. Robert Campbell, and others well acquainted with the character of the country from personal experience, and have the assurance of the services of Mr. Bridger if the exploration should be ordered.

On account of the great distance of the region to be examined from the settlements, it is necessary to provide the expedition with the means for remaining two summers, the intervening winter to be passed at some suitable point on the Yellowstone or Big Horn rivers. It would be difficult for an expedition to do more than go and return in the same season, so that then little or no time would be allowed to explore. The country is principally occupied by the Crow Indians, and, as I know them to be friendly, I think a military escort can be dispensed with, which is a material consideration under the present excessive requirements of the military service. The method I propose instead is, to go well provided with goods and presents by which to purchase of the Indians permission to pass through the country, and to employ them as guides. In this way much expense can be prevented, and, with prudent management, danger to the expedition can be avoided; besides, valuable information will be gained from the Indians which would be withheld if we entered their country in a hostile attitude.

The expedition should be completely organized and equipped for the field by the 1st of May, 1859, and remain in the field until the 1st of December, 1860, nineteen months.

There should be thirty men, at \$30 per month, and eight assistants, as topographers, collectors, guides, &c., at \$125 per month. This would require \$38,000. Their provisions would cost about \$7,000. Animals and outfit \$10,000. Indian goods \$4,000. Contingencies \$3,000. Total \$60,000. Of this amount about \$35,000 would be required the first year. The bulk of the stores and goods required should be contracted for, to be delivered at Fort Laramie or the Platte Bridge.

The expedition itself should proceed by the Missouri River to Fort Pierre, where the necessary animals for a pack train should be assembled. At this point we should meet with some of the principal men of the Dakotas, and overtures should be made to secure their assent to our proceeding westward up the Shyenne and its North Fork, and thence to the source of Powder River, thus exploring a new route. Should this consent be withheld, and it should not be considered safe to proceed without it, the party could take the route by way of White River to Fort Laramie and thence to the source of Powder River. The exploration should then be conducted along Powder River to its mouth, thence up the Yellowstone to the mouth of Tongue River, up which stream a detachment should be sent to its source. The remainder of the party should ascend the Yellowstone to the mouth of Big Horn River, and up this latter stream to the point where it leaves the mountains, where it should be joined by the detachment which explored Tongue River.

The approach of winter might require the party to pass that season in this neighborhood, or, if time sufficed, the expedition might ascend the Big Horn River to Wind River, where a very favorable wintering place could be found. Either of these places would be sufficiently convenient to the supplies on the Platte. Under circumstances not foreseen it might be best for the expedition to winter near Fort Laramie.

The next season should be spent in examining the mountain region about the sources of the Yellowstone and Missouri, to ascertain the character of the routes leading south and west from the navigable parts of these rivers. On returning, one portion should descend the Missouri, the other the Yellowstone, to their junction, where a Mackinac boat should be in readiness, by which all could proceed to the settlements.

These explorations would determine the practicability of all the routes marked on the accompanying map as deserving examination, and would require much activity on the part of those conducting them. Pack trains should alone be used, as wagons greatly retard the operations of a party and vastly increase the difficulty of defending it against attack. The abundance of game in much of this region would render it unnecessary to provide the usual quantity of bread and bacon, which always make the bulk of the provisions required.

The party must be well prepared for defense against war parties, and it would be desirable to arm each man with a revolver, and about three-fourths of them, in addition, should have a double-barreled gun, one rifled, the other smooth. This is a most effective gun either for hunting or fighting.

Copies of my instructions from the Hon. John B. Floyd, Secretary of War, dated May 6, 1857, and from Brevet Brigadier-General W. S. Harney, dated June 3, 1856, are transmitted herewith.

Very respectfully, your obedient servant,

G. K. WARREN,

Lieutenant Topographical Engineers.

Capt. A. A. HUMPHREYS,

Corps of Topographical Engineers,

In charge Office Explorations and Surveys.

WAR DEPARTMENT,

Washington, May 6, 1857.

SIR: Under the appropriation "for surveys for military defenses, geographical explorations, and reconnaissances for military purposes," you will organize an expedition to ascertain the best route for continuing the military road between Fort Snelling and the mouth of the Big Sioux to Fort Laramie and the South Pass, by way of the Loup Fork of the Platte; to make also such explorations in the Black Hills, about the sources of the Shyenne and Little Missouri rivers, as the time and means will permit; and to examine the Niobrara or l'Eau qui Court River, upon your return route, for the purpose of ascertaining its character and resources and the practicability of locating a road along it, leading from the Missouri River to the South Pass, or from Fort Randall to Fort Laramie.

The sum of twenty-five thousand dollars is set apart from the appropriation to defray the expenses of the expedition, which amount your expenditures must not exceed.

The commanding general of the Department of the West will be directed to detail an escort of thirty enlisted men of the infantry, under the command of a second lieutenant, who will report to you for duty.

Transportation for the provision and equipage of the escort, their subsistence, and their necessary ammunition, will be furnished, respectively, by the Quartermaster's, Commissary, and Ordnance Departments.

Upon the proper requisitions, officers of the Quartermaster's and Commissary Departments at the military posts near the routes pursued by the expedition will furnish, as far as practicable, all necessary supplies for it, which, when required for the civil employés, shall be paid for at cost prices at the places of delivery, from the appropriation for the survey.

Twenty Colt's revolvers, of the Navy pattern, with belts, holsters, and the necessary ammunition, will be furnished by the Ordnance Department; those lost or damaged being paid for out of the appropriation for the survey.

All other arms and ammunition for the civil employés (guides, hunters, herders, &c.) of the expedition will be paid for from this same appropriation.

You are authorized to employ as assistants—

	Per month.
A topographer, at a salary not to exceed.....	\$130
One assistant topographer, at a salary not to exceed.....	100
An assistant astronomer, at a salary not to exceed.....	125
A physician and geologist, at a salary not to exceed.....	125
An assistant physician and geologist, at a salary not to exceed..	100
A meteorologist, at a salary not to exceed.....	60

And to pay their actual traveling expenses to and from the field of operations.

You will procure your employés equipment, supplies, &c., at those points which appear to insure the most economical and effective organization for your party, and prepare to take the field at the earliest possible moment. While in the field, attention will be given to ascertaining everything relating to the agricultural and mineralogical resources of the country, its climatology, its topographical features, and the facilities or obstacles which these latter offer to the construction of rail or common roads.

You will communicate with the Department through the Office of Explorations and Surveys, in charge of Capt. A. A. Humphreys, Corps

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May 6, 1857.
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Topographical Engineers; and to this office you will make the reports and returns required by regulations of an officer of engineers in charge of a work or operation, and such other reports transmitted as often as the means of communication will allow, and will keep the Department apprised of all your movements, and the progress of the expedition under your charge.

On the completion of the field duty, you will return, with your assistants, to Washington, and there prepare the maps and reports necessary to a full exposition of the results of the expedition.

Very respectfully, your obedient servant,

JOHN B. FLOYD,
Secretary of War.

Lieut. G. K. WARREN,
Corps Topographical Engineers.

[Special Orders No. 26.]

HEADQUARTERS SIOUX EXPEDITION,
Camp near old Fort Lookout, Missouri River, June 3, 1856.

I. As it is important to obtain reliable information of the Missouri River, from Fort Pierre to some point above the mouth of the Yellowstone, near which Governor Stevens' route strikes it, Second Lieutenant Gouverneur K. Warren, Topographical Engineers, is assigned to this duty, and will proceed with his party by the steamer St. Mary's to the point above indicated.

On his return, Lieutenant Warren will procure a sufficient number of Mackinac boats, for the transportation of his party, stores, &c., to enable him to effect a thorough examination of this part of the river.

II. The commanding officer of the Second Infantry will select an efficient party from his regiment, consisting of two non-commissioned officers and fifteen men, to report to Lieutenant Warren as his escort. They will be furnished with three months' provisions, equipage, &c.

III. The assistant quartermaster at Fort Pierre will furnish the necessary transportation, and such supplies as Lieutenant Warren may be entitled to from his department, for the proper execution of these instructions.

By order of Brevet Brigadier-General Harney.

A. PLEASANTON,
Capt. Second Dragoons, Acting Assistant Adjutant-General.

REPORT.

CHAPTER I.

ROUTES EXPLORED, AND MAIN INCIDENTS AFFECTING THEIR EXTENT AND DURATION.

In presenting the following report of explorations in Nebraska, made by me in the year 1857, I shall include also my previous reconnaissances in that Territory in the years 1855-'56, while attached to the staff of Brevet Brigadier-General W. S. Harney, commanding the Sioux expedition. As, at this time, a complete narrative of these cannot be made, I shall only mention the routes pursued and the nature of the examination, and then give what I consider the most prominent results.

A report of the explorations made in 1855, and map of the routes pursued by the Sioux expedition, have already been published by the United States Senate in a small document called "Explorations in the Dacotah Country." During that year routes were examined from Fort Pierre to Fort Kearney; from Fort Kearney to Fort Laramie, along the Platte River; from Fort Laramie to Fort Pierre; and from Fort Pierre to the mouth of the Big Sioux River.

In 1856 I started from Saint Louis for Fort Pierre, in the middle of April, accompanied by my assistants, Messrs. W. H. Hutton, J. H. Snowden, and F. V. Hayden, on board Captain Throckmorton's steamboat *Genoa*. During our passage up the Missouri we made a careful sketch of the river above the southern boundary of Nebraska by means of compass courses, and distances estimated from the rate of travel of the steamboat, and by astronomical observations for latitude. The elevated position of the pilot-house of the steamboat, which the politeness of the captain allowed us to occupy, afforded advantages for gaining a knowledge of the river, the extent of the sand-bars, and the size and quantity of timber on the banks, the nature of the bottom lands as regards marshes, &c., not equaled by those of any other means of reconnaissance, and the topographer at the same time could avail himself of the extensive and accurate knowledge of the pilot. Our observations, by means of forward and back sights, showed us that the effects of local attraction on the compass by the iron on the boat were not important, and the checks on the estimated distances, afforded by the results of observations for latitude, proved that these estimates were very accurately made by Messrs. Hutton and Snowden, who, by turns, prepared the sketch of the river.

As far up as the mouth of James River our advance had been quite rapid, the river being at a good stage; but a short distance above that point we encountered a sudden and heavy freshet in the river, (produced by rains,) with a current so rapid that our boat was unable to advance against it. From this cause we remained tied up to the bank a whole day. As soon as the river began to fall the velocity abated, and we proceeded on the voyage. So sudden, however, was the subsidence of the flood that, in five days after we had escaped the embargo of too much water, we found ourselves aground and drawing several

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The steamboat, having landed a portion of her freight at the place where we left her, reached Fort Pierre three days after us. On my arrival all the tribes of the Dakotas west of the Missouri, except the Sichangus and Ogallalas, were assembled in council, and a treaty of peace was made with them by General Harney, which terminated the Sioux war.

While ascending the river, the sketch of it was taken above Fort Pierre, as it had been below, by Messrs. Hutton and Snowden, and observations were made by me for latitude. At Fort Union a 16-inch transit was set up, and observations taken during a whole lunation; but owing to the cloudy condition of the nights during the time, and the shortness of the nights themselves, only two sets of observations were obtained on the moon and stars. The result of these gave the longitude of that post $104^{\circ} 02'$, with a limit of error of about $10'$.

While at Fort Union we saw the Assian Boon Indians. Having ascertained that a Mackinac boat could not be prepared for me before the 1st of September, I determined to make an examination of the Yellowstone during the month of August; and in carrying this out I was fortunate in being able to purchase the means of land transport from Sir George Gore, who was returning from an extensive hunting excursion on the waters of the Yellowstone and its branches. We left the mouth of the Yellowstone July 25, and, traveling leisurely

up the left bank, reached a point one hundred miles from its mouth, beyond which it was impossible to advance with wagons along the valley of the Yellowstone without crossing to the opposite banks. Here we made a camp with the main body, and with a party of seven I proceeded, with pack animals, over a very difficult country (known as the Bad Lands of the Yellowstone) to the mouth of Powder River, thirty miles further.

This was the furthest point up the Yellowstone that I intended to proceed, and I was anxious to reach it and to fix its position, as being a good and certain point with which any future reconnaissance could connect. From the appearance of Powder River at the mouth, no one would suppose the stream to be of the length it really is, and I was not surprised at Captain Clark not having done so on his voyage down the Yellowstone in 1806. On returning to our wagon camp, we all traveled a short distance down the Yellowstone to a convenient point, where we made a boat eighteen feet long and five feet wide, by stretching the skins of three buffalo bulls over a frame made of small cottonwood and willow trees. With this vessel a small party navigated the Yellowstone to its mouth, carefully mapping the islands and bends of the river. The wagons and land party returned to the Missouri by traveling over nearly the route by which they ascended.

We enjoyed the greatest abundance of large game of all kinds while on the Yellowstone River.

On reaching Fort Union again we found our boat nearly ready, and, all our arrangements being completed, we left that place on the 1st of September. A small party conducted the animals along the shore on our journey down the Missouri, generally camping each night with the boat party. Halts of two or three days were made at all interesting localities, and map sketches were made several miles up all the streams flowing into the Missouri; and the map of the Missouri was also verified. These sketches, on a scale of one and a half inch to a mile, are on file and convenient for reference in this office.

Thermometer and barometer observations were made throughout the period of the examinations of the year 1856. Dr. Hayden was indefatigable in his efforts to develop the geology of the region traversed, and some of the results have already been published, by permission of the War Department, in the Proceedings of the Academy of Natural Sciences in Philadelphia. A very extensive collection was also made in zoology.

We reached Fort Pierre on our return on the 2d of October, at which place our animals were sold, and most of the soldiers returned to their respective companies. A few accompanied us as far as the mouth of the James River. We reached Sioux City on November 15, and fortunately found a steamboat there, by means of which we proceeded with our effects to Saint Louis, and thence by railroad to Washington. The cost of this expedition to the United States was about \$10,000.

No special report has yet been made by me on the results of this year's exploration. The maps were about completed, and the material in the process of elaboration, when I was assigned to the command of another exploration by the War Department, a brief account of which I shall now proceed to give.

I received my instructions from the Hon. John B. Floyd, Secretary of War, May 7, 1857, the general terms of which were to make the necessary examinations to determine the best route for continuing the military road between Mendota and the Big Sioux westward to Fort

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Laramie and the South Pass; thence to proceed northward and make such examinations on the Black Hills as my time and means would permit, and to return by the valley of the Niobrara, and make a careful examination thereof. I was assisted in the examination by Messrs. J. H. Snowden and P. M. Engel, as topographers; Dr. F. V. Hayden, as geologist; W. P. C. Carrington, as meteorologist; Dr. S. Moffitt, as surgeon; and Lieut. Jas. McMillan commanding the escort.

The escort, numbering twenty-seven men and three non-commissioned officers, under Lieutenant McMillan, ail of the Second Infantry, was directed to meet me at Sioux City, transportation for it being furnished by the Quartermaster's Department. Transportation for the remainder of the party was assembled at Omaha City as soon as possible; and on the 27th of June, under the charge of Mr. Snowden, set out for the rendezvous at the mouth of Loup Fork.

Accompanied by Mr. Engel, I then proceeded to Sioux City, where we found the escort had been awaiting us several days on the Big Sioux River. Through some misunderstanding there were no teamsters furnished for the wagons of the escort; and the mules, from a disease of the hoof, and the wagons, and especially the harness, from long use, were of very inferior quality. It occupied me six days in getting the train in traveling condition, which was only done by abandoning one wagon and a large supply of stores for the escort. During this time a rumor* reached there of a fight having taken place between the soldiers and the Shyennes at Ash Hollow, in which a hundred of the former were killed. Twelve of the soldiers of the escort, tempted by the high prices of labor in this vicinity, and tired of the toils and privations of campaigning, deserted as we were about to set out, and some white thieves who infested the neighborhood of Sioux City carried off two of my best horses. These losses occurring in a civilized community, where we supposed ourselves among friends, were quite annoying, and gave rather unpleasant forebodings of what might occur to us when we should come among our enemies, the Indians.

We set out from Sioux City July 6, and, taking a direct course, joined the other party on the Loup Fork, being 11 days in going 110 miles. The route was heavy from frequent rains, all the ravines being filled with water, and the most insignificant rivulet requiring preparation, on account of the soft nature of the soil, before a wagon could cross it. We had to make one bridge (over Middle Creek) about 30 feet long, and construct a raft with which to cross the Elk Horn.

The united party now set out on their journey westward on the Loup Fork, meeting with no serious difficulties on the route (except the quicksands in crossing the main north branch) till we came to within 50 miles of the source of the stream. Here the river became shut up in a gorge impassable for wagons, and we were forced out among the difficult sand-hills which border the bluffs, and which extend north to the Niobrara and south nearly to the Platte. They also extend much further east, but they occasioned us no difficulties till we were forced to leave the bank of the stream.

We finally came to the source of the Loup Fork, and from this point endeavored to proceed as directly as possible north to the Niobrara, for we were somewhat apprehensive of losing everything, for want of water, by endeavoring to push our way westward through the Sand Hills. These hills, however, were so impracticable for wagons that we were forced much more to the west than we desired, and one day we were unable to find water to camp by. There are numerous lakes in this Sand

* This rumor was without foundation, as it afterwards appeared.

Hill country, but many of them are too much impregnated with salts to be wholesome. Some of these latter our animals drank out of without injury. On reaching the longitude of $102^{\circ} 30'$ we had the good fortune to find an open stretch of country, with a large, well-marked lodge-trail leading between the Platte and Niobrara, which, in one day's travel northward, brought us to the Niobrara. We now proceeded rapidly over an easy route to Fort Laramie.

During the journey there had been considerable sickness in the camp from fevers, and one of the men was so near the point of death that a halt of several days was made for his benefit. Dr. Moffitt also became so ill as to require a delay of one or two days. These necessary stoppages, the difficulties of the route, rainy weather, together with my being obliged to leave so much of our provisions behind at Sioux City, reduced our supplies to a small amount, and for nearly two weeks we were without sugar or coffee. We had also been very much disappointed in the amount of game; and though the country gave evidence of having recently been occupied by large herds of buffalo, only a few bulls were seen. During the early part of the journey, mosquitoes were abundant, and allowed our animals no rest at night, and immense numbers of flies attacked them by day. These insects, combined, exhausted and worried the animals more than the labor they performed, and the lives of one or two were saved only by covering them with grease and tar to keep the flies and mosquitoes away.

At Fort Laramie we entirely refitted the party, which took us a long time, on account of everything being required for the Utah expedition. It gives me great pleasure to state that the commanding officer, Colonel Hoffman, and the acting quartermaster, Lieutenant Higgins, gave me all the facilities at their command. Owing to the great number of animals that graze in the neighborhood, the grass was nearly eaten off, and our animals recruited very little during our stay there. While there I succeeded in getting several sets of observations for moon culminations, which determined the longitude to be $104^{\circ} 30'$, with a limit of error of about $4'$. Dr. Hayden and Mr. Engel also made an excursion to Laramie Peak, which they ascended.

The party, on leaving Fort Laramie, was divided into two parts, as, owing to the lateness of the season, it was impossible to accomplish all the objects of the expedition by keeping together. Though in doing this I subjected each portion to the possibility of being defeated by the Indians, I deemed the case to justify the risk. The wagons were, half of them, turned in to the quartermaster, and the remainder, with the escort under Lieutenant McMillan, were to proceed down the Niobrara, and await me in longitude $101^{\circ} 30'$. Mr. J. H. Snowden went with this party to make the topographical reconnaissances; Dr. Moffitt also accompanied it. My own party consisted of Dr. Hayden, Mr. Carrington, and Mr. Engel, and we had with us 17 men as packers, &c., and Mr. Morin as a guide and interpreter. Our supplies were packed on mules.

Setting out from Fort Laramie on the 4th of September, we proceeded direct for the Black Hills via Raw Hide Butte, Old Woman Creek, the South Fork of the Shynne, and Beaver Creek; up a branch of this last we entered the Black Hills. We continued north to the vicinity of the Inyan Kara, (or the peak which makes the mountain,) a remarkable high basaltic peak, one of the highest of these mountains, and so far to the north that we had a full view of the prairie beyond.

Here we were met by a very large force of the Dakotas, who made such earnest remonstrances and threats against our proceeding into their country that I did not think it prudent for us, as a scientific expe-

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dition, to venture further in this direction. Some of them were for attacking us immediately, as their numbers would have insured success; but the lesson taught them by General Harney, in 1855, made them fear they would meet with retribution, and this I endeavored to impress upon them. We were at the time almost in sight of the place where these Indians had plundered Sir George Gore in 1856, for endeavoring to proceed through their country, and one of them was actually mounted on one of his best horses, taken at that time. Sir George Gore's party was only about half as numerous as mine; but there were a number of my party which I had picked up at Fort Laramie on whom we placed very little reliance.

The grounds of their objections to our traversing this region were very sensible, and of sufficient weight, I think, to have justified them in their own minds in resisting; and as these are still in force for the prevention of the passage of any other party of whites not large enough to resist successfully, they are of sufficient importance to be repeated here. In the first place, they were encamped near large herds of buffalo, whose hair not being sufficiently grown to make robes, the Indians were, it may be said, actually herding the animals. No one was permitted to kill any in the large bands for fear of stampeding the others, and only such were killed as straggled away from the main herds. Thus the whole range of the buffalo was stopped so that they could not proceed south, which was the point to which they were traveling. The intention of the Indians was to retain the buffalo in their neighborhood till their skins would answer for robes, then to kill the animals by surrounding one band at a time and completely destroying each member of it. In this way no alarm is communicated to the neighboring bands, which often remain quiet almost in sight of the scene of slaughter.

For us to have continued on then would have been an act for which certain death would have been inflicted on a like number of their own tribe had they done it; for we might have deflected the whole range of the buffalo fifty or one hundred miles to the west, and prevented the Indians from laying in their winter stock of provisions and skins, on which their comfort if not even their lives depended. Their feelings toward us, under the circumstances, were not unlike what we should feel toward a person who should insist upon setting fire to our barns. The most violent of them were for immediate resistance when I told them of my intentions; and those who were most friendly, and in greatest fear of the power of the United States, begged that I would "take pity" on them and not proceed. I felt that, aside from its being an unnecessary risk to subject my party and the interests of the expedition to, it was almost cruelty to the Indians to drive them to commit any desperate act, which would call for chastisement from the Government.

But this was not the only reason they urged against our proceeding. They said that the treaty made with General Harney gave to the whites the privilege of traveling on the Platte and along White River, between Forts Pierre and Laramie, and to make roads there, and to travel up and down the Missouri in boats; but that it guaranteed to them that no white people should travel elsewhere in their country, and thus frighten away the buffalo by their careless manner of hunting them. And, finally, that my party was there examining the country to ascertain if it was of value to the whites, and to discover roads through it, and places for military posts; and that having already given up all the country to the whites that they could spare, these Black Hills must be left wholly to themselves. Moreover, if none of these things should

occur, our passing through their country would give us a knowledge of its character and the proper way to traverse it in the event of another war between themselves and the troops. I was necessarily compelled to admit to myself the truth and force of these objections.

The Indians whom I first met were the Minikanyes, to the number of forty lodges, near whom, as they were very friendly, we encamped.* They were soon joined by the warriors of a large camp of Unkpapas and Sihasapas, and our position, which was sufficiently unpleasant in the presence of such a numerous party of half-avowed enemies, was rendered doubly so by a storm of sleet and snow, which lasted two days and nights, and against which we had but little protection.

A young Indian, who had accompanied us from Fort Laramie, considered the danger to us so imminent that he forsook our camp and joined his friends, the Minikanyes.

Under these embarrassing circumstances my associates evinced the most resolute bravery and determination to abide the result like true men.

I consented to wait three days without advancing, in order to meet their great warrior, Bear's Rib, appointed first chief by General Harney's treaty, merely changing our position to one offering greater facilities for defense. At the expiration of the time, Bear's Rib not making his appearance, we broke up camp, and, traveling back on our route about forty miles, struck off to the eastward, through the southern part of these mountains. The point where we turned back is well marked by the Inyan Kara Peak, whose position was fixed by us.

After we had proceeded two days on our journey eastward, we were overtaken by Bear's Rib and one other Indian who accompanied him. He reiterated all that had been said by the other chiefs, and added that he could do nothing to prevent our being destroyed if we attempted to proceed further. I then told him that I believed he was our friend, but that if he could do nothing for us, he had better return to his people, and leave us to take care of ourselves, as I was determined to proceed as far as Bear Butte. After a whole day spent in deliberation, he concluded to accompany us a part of the way, and he said he would then return to his people and use his influence to have us not molested. In return for this, he wished me to say to the President and to the white people that they could not be allowed to come into that country; that if the presents sent were to purchase such a right, they did not want them. All they asked of the white people was, to be left to themselves and let alone; that if the presents were sent to induce them not to go to war with the Crows and their other enemies, they did not wish them. War with them was not only a necessity but a pastime. He said General Harney had told them not to go to war, and yet he was all the time going to war himself. (Bear's Rib knew that when General Harney left the Sioux country he had gone to the war in Florida, and was at the time in command of the army sent against the Mormons.) He said, moreover, that the annuities scarcely paid for going after them; and that if they were not distributed to them while they were on their visit to the trading-posts on the Missouri to dispose of their robes, they did not want them.

(It is a fact that for several years, owing to this cause, these Indians have not come in for their goods at all.)

He said that he heard that the Ihanktonwans were going to sell their

* I am much indebted to the influence of Major Twiss, the Indian agent near Fort Laramie, for his efforts to give the Dakotas a favorable opinion of my expedition, and to secure us a friendly reception.

lands to the whites. If they did so, he wished them informed that they could not come on his people's lands. They must stay with the whites. Every day the Ihanktonwans were coming there but were always turned back.

Whatever may have been Bear's Rib's actions after leaving us, it is certain we saw no more Indians in the Black Hills. We completed our reconnaissance along the eastern portion of these mountains as far as Bear Peak, which forms another convenient and accurate point with which any future reconnaissance may connect with our own. We also visited the North Fork of the Shyenne, in this vicinity. On our return we took a southeast direction, striking the South Fork of the Shyenne at the mouth of Sage Creek. We then proceeded up the South Fork to French Creek; thence southeast, through the Bad Lands, to White River; thence along the sources of White Clay Creek and Porcupine Creek; and thence to the Niobrara, striking it in longitude $102^{\circ} 03'$.

We found the party under Lieutenant McMillan about forty miles below where we struck the river, and eighty miles below where we had first reached it on our journey westward in August. This intervening distance had been carefully mapped by Mr. Snowden, and he had made several excursions at different places to examine the country, as I had directed. Lieutenant McMillan's march down the river thus far had not been made without much wordy opposition from the Brulé Dakotas, much of the same kind as that I have related as having been said to me in the Black Hills. On finding that he was determined to proceed, the chief, Little Thunder, sent four of his principal men to accompany them, which they did for some days. At a subsequent time, twenty-two warriors charged into the camp, thinking the party was a trading-expedition. Their insolence was checked by Lieutenant McMillan's threatening to fire on them; whereupon they entered their usual protest against the party's proceeding further, and the next day all withdrew. The last twenty miles of Lieutenant McMillan's route was through difficult sand-hills bordering the river, the stream itself being so shut in by high precipitous ridges that he was unable to travel along it.

We now found the route exceedingly laborious for wagons on account of the sand-hills, which continue to the mouth of Rapid Creek. The character of the immediate valley of the Niobrara precluded the wagons from traveling along it; so, while Mr. Snowden mapped the route of the train, Mr. Engel traveled along the river, sometimes on one side and sometimes on the other, and made a map of it. Even he, though riding a mule, found it difficult to keep up in this way with the wagons, which slowly wound their way through and over the sand-hills. Our camps at night were here always on the main river. After passing the Rapid Creek, the sand-hills gave us no longer any trouble, (except for about twenty miles on the point between the Niobrara and Keya Paha,) but the ravines and precipices still prevented the wagons from traveling within from five to eight miles of the Niobrara, and here Mr. Engel continued the sketch as before. Dr. Hayden also traveled along the immediate banks of the river, examining the character of the rocks and collecting fossils.

On reaching the mouth of the Keya Paha, the main party, with the wagons, proceeded direct to Fort Randall, and a separate party, under Mr. Engel, traveled down the Niobrara to its mouth, completing the examination of that stream. It was my intention for Dr. Hayden to accompany him, but on arriving at the place of separation we found the same geological formation and characteristics as we knew to exist

at the mouth; and as the intervening distance was only sixty miles, he did not deem it necessary to go over it.

Fort Randall was reached on the 1st of November, and the escort was returned to the regiment. We were most hospitably received by Major Day, commanding the post, and the other officers of the Second Infantry, and I take this occasion to acknowledge my indebtedness to this regiment for the aid and protection they have afforded me in all my explorations.

Two sets of observations for moon culminations were obtained here, but cloudy weather prevented more. The longitude as calculated from them, is $98^{\circ} 34'$, with a probable limit of error of about $8'$.

The party set out from Fort Randall on the 7th of November, and surveyed the route to Sioux City, which was reached on the 16th. The season being far advanced, no steamboat was expected, and the river was full of floating ice. The weather as we traveled on toward Fort Leavenworth became very severe, and the river became frozen over as far down as Saint Joseph's. During this time we made rapid progress, but a mild spell of weather coming on made the road so heavy that with the greatest exertion we hardly accomplished ten miles a day. During this time the health of the party suffered severely from influenza. We reached Fort Leavenworth on the 4th of December, and were fortunate enough to meet there with a steamboat, by which we proceeded to Saint Louis, and thence by railroad to Washington.

CHAPTER II.

PHYSICAL GEOGRAPHY OF NEBRASKA; CHARACTER OF THE SOIL AND RESOURCES OF THE COUNTRY.

Though my personal examinations have nowhere extended west of the 106th meridian, there are certain points west of it to which I would direct attention. The positions of the Missouri and Yellowstone west of this meridian and north of the 46th degree of north latitude have been well examined by Lewis and Clark and under Governor Stevens, and the valuable information they obtained is widely known. The section, however, between the 46th parallel in the north and the 43d in the south, the 106th meridian in the east, and the dividing line between the waters of the Pacific and the Atlantic in the west, is comparatively unknown, except from the accounts afforded by trapping-parties. The information given of it on the map of Lewis and Clark is derived from this latter source; as is also that on Colonel Bonneville's map, published with Irving's work on "Adventures in the Rocky Mountains," &c. &c. These are our most authentic sources of information. These maps have been generally disregarded by subsequent map-makers, and previous to the map I compiled for the Pacific Railroad Office, there have been no mountains represented about the source of the Yellowstone. From inquiries I made of trappers in 1855, I became convinced of the existence of these mountains, and represented them accordingly, endeavoring to combine the information on Lewis and Clark's map and Bonneville's map with that which I had procured from traders and trappers. In doing this, I represented the Big Horn Mountains perhaps too far to the west, as they are perfectly visible from the summit of the Inyan Kara Peak, in the Black Hills.

Leaving out of consideration for the present the smaller detached mountain masses, and beginning with the main range of the Rocky

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Mountains, on the 49th parallel, we find their eastern base to have a direction nearly northwest and southeast, and the range crossing the Missouri at "The Gate of the Mountains." Continuing southeast, it crosses the Yellowstone near where Captain Clark reached that river in 1806, (latitude 46,) just south of which it forms high, snow-covered peaks. This line of mountains is broken through again by the Big Horn River, and the mountains receive the name of Big Horn Mountains. The southeast terminus of the Big Horn Mountains sinks into the elevated table-land prairie, and the range, perhaps, re-appears again as the Laramie Mountains. (South of the latitude of Fort Laramie the line of the eastern front of the mountains is nearly north and south.)

The Black Hills, whose geographical position we have determined, are the most eastern portion of what has heretofore been considered a part of the great mountain-region west of the Mississippi; and it is worthy of note that, if a line be drawn from them to the Little Rocky Mountains, on the 48th parallel, which are the most eastern portion in that latitude, this line will be parallel to the line of the main front of the mountains which I have already traced. What is still more significant is, that if a straight line be drawn from the mouth of the Yellowstone to the mouth of the Kansas River, it will also be parallel to the lines before mentioned, and will have about an equal portion of the Missouri on each side of it.

The line of the east base of the main mountain mass is the highest, of course, of any portion of the plains, and at Raw Hide Peak, near Fort Laramie, is about 5,500 feet elevation, as determined by the horizontally stratified Tertiary deposits, though, owing to great denudation, the average height there of this line of the plains will not be so great. The same line, near the 49th parallel, has probably a somewhat less elevation. The lowest line of the plains is that along the Missouri, and its elevation, taken near Bijou Hills, (a point about on the perpendicular to it from Fort Laramie,) is about 2,130 feet, which does not differ materially from its height at the mouth of the Yellowstone. The slope of all this part of the plains (being in a direction perpendicular to the lines of equal elevation) has therefore its line of greatest descent in a north-east direction, and north of the Niobrara; this is the direction in which a majority of the rivers flow till they join with the Missouri or Yellowstone. To the south of the Niobrara the greatest slope of the plains is to the southeast, toward the Gulf of Mexico, and this is the direction pursued there by nearly all the rivers of the plains. Thus the Niobrara would seem, as it were, to run along a swell or ridge on the surface. The average slope of the plains from the Missouri to the mountains make nowhere an angle greater than one-half degree with the horizon.

A remarkable feature in regard to this change of slope which occurs in the neighborhood of the course of the Niobrara is the shortness of its tributaries, the surface drainage seeming to be away from and not toward its banks. A result of this is the absence of the amphitheater-like valley which rivers generally have, and which enable us to look down at the stream often many miles distant. Through the greater portion of the middle half of its course you have scarcely any indication of it as you approach, till within close proximity, and then you look down from the steep bluffs and catch, at the distance of two hundred to five hundred yards, only here and there a glimpse of the river below, so much is it hidden by the precipitous bluffs which, at the bends, stand at the water-edge. So strongly was I impressed with the fact that the surface drainage could never have been directed along its course so as to have worn out this channel, that I think a portion of

it must have originated in a fissure in the rocks, which the waters have since enlarged and made more uniform in size, and which the soft nature of the rock would render easy of accomplishment. It is worthy of remark, in this connection, that the bed of the stream in longitude 102° is 400 feet higher than that of the White River at the point nearest to this; White River having there cut its way entirely through the Tertiary formation, flows along the Cretaceous, while the bed of the Niobrara is in the Miocene Tertiary, the Pliocene forming the bluffs. The bed of the Niobrara is also, in two-thirds of its upper course, from 300 to 500 feet above the bed of the Platte River at corresponding points at the south.

In the section of the country through which the Niobrara flows the soil is very sandy, so that what rain or snow falls sinks under the surface, and none is lost by evaporation. This is gradually all poured into the stream by the springs in the ravines, and in this way the river is mainly supplied in seasons of low water, at which times it is one of the largest streams of Nebraska.

The question of the slope of the plains is a subject to which I have given much attention, from its scientific as well as practical interest. Our barometric observations have enabled us, in some measure, to fill up the gap between those of Governor Stevens on the north and Captain Frémont's on the south, and thus give us the connected levels over a very large area.

The observations upon the great Tertiary formation have developed the fact, that since the close of the Pliocene period, the eastern base of the mountains, which is the western limit of this formation, has been elevated from 2,000 to 3,000 feet above the eastern, and this without there being anywhere visible signs of upheaval, such as inclination of the strata. The only direct evidence is in the immense denudation which the Tertiary has undergone probably while this elevation was in progress, and which causes of denudation must have been gradually extinguished, as there is, at the present time, no force at work sufficient to have affected them. The evidence goes to show that the elevation which has taken place since the close of the Pliocene period has been in Nebraska remarkably uniform, and along a line in a general direction northwest and southeast, and nearly coincident with the ranges of mountains previously upheaved.

The Black Hills received their last violent upheaval at the same period as the Laramie Mountains, that is, at the close of the Cretaceous. The geological evidence goes to show that the Pliocene and Miocene Tertiary, south of the Shynne, are fresh-water formations; yet there are no ridges now standing to mark the northern boundary to this basin. In the present relative position of the different parts of these plains, the elevation of the Pliocene Tertiary formation is now so great that much of the Black Hills and the Cretaceous on the Shynne should have been covered with it. This might, however, have been the case, and since have all been denuded away. North of the Shynne the Cretaceous ridges are probably sufficiently high to have separated the Tertiary beds south of it from the Lignite Tertiary to the north. But still it is necessary to suppose that this last elevation of the Tertiary has been somewhat greater near the 42d parallel than to the north of it.

A most interesting problem could be solved in regard to these changes of level, if a locality could be found where the Lignite Tertiary north of the Shynne would be in contact with the Pliocene or Miocene beds to the south of it, as well as the more important one of the age of the first relative to the two latter.

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During the time of these changes since the formation of the Pliocene Tertiary, the soft sandy material of which it was composed has been crushed and separated by denuding forces, and an area of no less than 20,000 square miles, called the Sand Hills, has been covered with barren sand, which, blown by the wind into high hills, renders this section not only barren, but in a measure impracticable for travel. The Niobrara River, lying on a most desirable line of communication, and direct in its general course, has one hundred miles of its banks obstructed with these difficult hills, and the communication between this stream and the Platte greatly obstructed and in some places entirely cut off. The subject of routes and communications I shall hereafter take up in detail.

For nearly all of the knowledge of the age of the geological formations of the portions of Nebraska developed by my explorations, I am indebted to the services of Dr. F. V. Hayden and Mr. F. B. Meek and Professor Joseph Leidy, whose papers, published in the Proceedings of the Academy of Natural Sciences, have already made known some of the principal discoveries and results due to their labors. Dr. Hayden was the only one of those mentioned who accompanied me in the field.

In the paper by Dr. Hayden, accompanying the geological map, published in June, 1858, Dr. H. observes that "a much larger surface might have been colored on the map with a good degree of confidence, but I have preferred to confine myself, for the most part, to the results of my own observations in the field." The northeast portion of the boundary of the Tertiary formation between the White and Niobrara rivers is there placed too far west, according to my own observations in 1855 and 1857. The line between this and the Cretaceous is not west of a straight line between the mouth of the South Fork of the White River and the mouth of the Keya Paha. A small portion of Tertiary should also be shown on the north side of the South Fork of the Shyenne. The great Lignite Tertiary formation most probably extends almost to the base of the Big Horn Mountains.

It is of course impossible to give correctly the relative extent of certain of the formations on a map of this scale. The width of the upheaved sedimentary formations which encircle the igneous rocks of the Black Hills is much more developed on the western than on the eastern slopes, owing to their difference in dip—on the western being quite gentle, but steep on the other, causing them soon to disappear under the Cretaceous rocks; and this is one of the most important features in the configuration of these mountains.

From what has been said it will be seen that the surface of Nebraska presents two great sections—that of the plains and that of the mountains.

The plains in this latitude are composed of nearly horizontal strata of the Tertiary and Cretaceous formations, except in a small portion of the southeast corner, where the Carboniferous is developed. Though the plains are much diversified by the effects of denuding agencies, and present in different portions striking characteristics, yet they are, as a whole, a great uniform surface gradually rising toward the mountains, at the base of which they attain an elevation varying between 3,000 and 5,500 feet above the level of the sea. The plains have three distinct portions as determined by their geological formation: 1st, the Pliocene and Miocene Tertiary; 2d, the Cretaceous; and, 3d, the Lignite Tertiary.

The first section extends from the southern boundary north, nearly

continuous to the 44th parallel, and contains a large portion of the valleys of the Platte, Loup Fork, Niobrara, and White Rivers. Here, except in the immediate valleys of the streams, which are composed of good soil, naturally irrigated by springs from the bluffs, or susceptible of irrigation, much of the country is sandy and unfit for cultivation. No valuable mineral or good building stone has been discovered in it. Here are to be found the Sand Hills, which occupy an area north of the Platte of not less than 20,000 square miles. These hills on the north begin between the White and Niobrara rivers, and extend south probably beyond the Arkansas. Where we have visited them, they vary in height from 10 to 200 feet, and in the western portion are ranged in ridges running east and west; but in traveling you are frequently obliged to cross them, as the intermediate valleys, which are also sand, are not continuous. About the sources of Loup Fork many of the lakes of water found in them are impregnated with salts and unfit to drink, and our sufferings in exploring them will always hold a prominent place in our memories. The present form of these hills is mainly if not entirely due to the wind. Where the grass protects the surface the sand does not drift; but if this is removed, the wind whirls the sand in the air, and often excavates deep holes. I therefore look upon them as utterly impracticable for any line of railroad; for should any attempt be made to grade the surface, which would be necessary, the wind would fill up the cuts with sand as with drifting snow.

In this section is also to be found the Bad Lands, or Mauvaises Terres, of White River, so celebrated for their vertebrate remains. The locality to which this name (Bad Lands) has been applied is in extent about one hundred and fifty miles long, in a direction northeast and southwest, and about sixty miles wide. The term "Bad Lands" was given to this section by the traders, on account of the difficulty of getting a road through a portion of it. The extent of the geological formation to which these Bad Lands belong is very great, and, as the name is an improper one to be applied to the whole of it, I shall not use the term except in speaking of the portion occupied by it along the middle course of the White River. In this part of White River some as beautiful valleys are to be found as anywhere in the Far West, though, like other parts, the majority of the country is barren. These Bad Lands of the White River country have frequently been spoken of as a vast grave or sepulchre, from the amount of bones found there; and this figure of speech has somewhat tended to give a gloomy idea of the place which it does not especially deserve, as it abounds in the most beautiful and varied forms, in endless variety, giving the most striking and pleasing effects of light and shade. It has also been described as having sunk away from the surrounding world, with the country rising like steps to the Black Hills, which is not the case, many portions of these Bad Lands being higher than all the intervening country between them and the Black Hills, from which the portions on White River are distant about thirty miles. The formation to which this portion belongs extends almost uninterruptedly east to the mouth of the Keya Paha, and south beyond the Platte; and an instance of the striking appearance which it sometimes makes is exhibited in Court-House Rock and Scott's Bluffs. The term "Bad Lands" is generally applied by the traders to any section of the prairie country where roads are difficult, and in this way to parts of many distinct geological formations, and, as it is generally calculated to mislead, should not be used. When I shall use it occasionally, I use only the name of the country, as it was originally given to mean bad land to travel through.

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The *second section* is the Cretaceous formation, forming the level country at the base of the Black Hills, the valley of the Shyenne River, and the immediate valley of the Missouri River, from Heart River to the Big Sioux. In this section the soil is clayey; and wherever there is a sufficiency of rain, or streams can be found to irrigate the land, it will be productive. The great drawback to its fertility is a want of timely rains. A portion of this formation, from the Big Bend to the Shyenne, is composed of black shale, and contains much saline matter, which renders the water in places unhealthy, and adds to the sterility of the soil along the bluffs of the streams, where saline springs are common. In this section, too, there are no valuable minerals or good building stone, except that furnished by the bowlders.

The *third section*, or Lignite Tertiary, extends north and west to the British line. The want of rain, which is felt in this area even more than in the one to the south of it, renders it nearly barren. Everywhere through this formation, beds of lignite are to be found, sometimes of a thickness of 6 and 7 feet. The burned appearance of earth, along the banks of the streams, shows that in former times these beds have been on fire over large areas, and in places are entirely burned out, and those on Powder River are said to be on fire at this time. There is every reason to believe that in places this lignite will be found of quality good enough for fuel. In this section the bowlders furnish the only good building stone.

In nearly all parts of Nebraska good clay for making brick can be found.

The Carboniferous formation is developed in a small part of the southeastern portion of the prairie of Nebraska, and I will quote from the report of Dr. Hayden in relation to the coal of this section:

"The town of De Soto is the highest point known on the Missouri where these limestones are exposed. Ascending the valley of the Platte River, we find them quite well developed as far as the mouth of the Elk Horn, where they pass beneath the bend of the river, and the sandstone No. 1 occupies the country. "Several small seams of coal have been found in these limestones at Bellevue and other localities, and in the valley of the Platte. About ten miles above its mouth I noticed a bed of very dark carbonaceous shale, 2 feet in thickness, cropping out near the water's edge. This was considered by the inhabitants as a sufficient proof of the existence of a workable bed of coal in the vicinity. The evidence now points to the conclusion that though these limestones belong to the true Coal-Measures, they hold a position above the workable beds of coal, and that it is not probable a valuable seam of coal will be found north of the southern line of Nebraska. A bed of coal of inferior quality has been wrought near Leavenworth City, Kansas Territory, but it holds a lower geological position than the limestones of the southern portion of Nebraska, the dip of the strata being toward the northeast."

As our examinations were always somewhat hurried, there is room to expect that workable beds of coal may yet be found here, but at present we know of no facts against the opinion given by Dr. Hayden.

The seam of very inferior lignite found in the neighborhood of Sioux City in the Cretaceous rocks may possibly, in some places, furnish fuel of value, but where seen by us as exposed it gives but little promise. In this case, as well as the coal-seams in the Platte, mentioned above, it may be that on penetrating to the interior portions of those beds they will improve in quality.

The section of Nebraska which is now being occupied by settlers has

fertile soil, not surpassed by any portion of the prairies of the Mississippi Valley. In this eastern section will be found the fertile and wooded valley of the Elk Horn River, and all the wooded parts of the valley of the river Platte. In the southern portion of it good building stone is furnished by the Carboniferous rocks.

After passing to the west of the 97th meridian we begin to meet with sandy tracts, especially near the 42d parallel, in which latitude the sand-hills extend the furthest east. In my former report I said that but a small portion of Nebraska which I had visited is susceptible of cultivation west of the 97th meridian. I did not mean to imply that good land on these prairies would not be found west of it, for there are fertile tracts as far west as the 99th meridian, in the neighborhood of streams that are valuable, and contain wood enough to support settlements. In stating that the Territory is overspread by powerful tribes of roving savages, and is only adapted to a life such as theirs, I did not mean to imply that white men could not occupy it, but that if they ever did they would have to lead a life similar to that of the Indians, depending mainly for subsistence, not upon the buffalo, but their own herds and flocks for support; and this is most emphatically true of the region between the 99th meridian and the base of the mountains.

There is one thing concerning the longitudes of places west of the Missouri River which causes many persons to deceive themselves, and is worthy of mention here. A common idea is that the course of the Missouri is nearly south from Sioux City to Leavenworth City, and that settlers may go as far west of the one place as the other and find fertile lands. But the course of the Missouri between these points is so much to the east that Sioux City is only fifteen miles east of the meridian of Fort Riley, and Fort Randall is as far west as the western limit of the Cross Timbers on the 35th parallel.

Though the western portion of the prairies of Nebraska is not much inferior to that of corresponding meridians in Kansas and Northern Texas, there is no disguising the fact that a great portion of it is irreclaimable desert, with only a little wood and cultivable land along the streams.

The reasons for this are, 1st, an insufficiency of timely rains; 2d, over large areas the soil does not possess the proper constituents; 3d, the severity of the long, cold winters and short summers; and a 4th might be included in the clouds of grasshoppers that occasionally destroy the useful vegetation. They are nearly the same as the locusts of Egypt, and no one who has not traveled on the prairie and seen for himself can appreciate the magnitude of these insect swarms. Often they fill the air for many miles of extent, so that an experienced eye can scarce distinguish their appearance from that of a shower of rain or the smoke of a prairie fire. The height of their flight may be somewhat appreciated, as Mr. E. James saw them above his head as far as their size would render them visible while standing on the top of a peak of the Rocky Mountains, 8,500 feet above the level of the plains, and an elevation of 14,500 above that of the sea, in the region where the snow lies all the year. To a person standing in one of these swarms as they pass over and around him, the air becomes sensibly darkened, and the sound produced by their wings resembles that of the passage of a train of cars on a railroad when standing two or three hundred yards from the track. The Mormon settlements have suffered more from the ravages of these insects than probably all other causes combined. They destroyed nearly all the vegetables cultivated

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It must be observed, however, that good grass will generally be found all over these plains, varying in quantity and kind with different localities, and that the desert character of the country is not like that found in the deserts on Green River and Snake River, west of the South Pass, where even a sufficiency for animals cannot be found.

A very different condition of soil, water, and building-material of stone and wood, exists when we reach the mountain region.

The Black Hills, or more properly mountains, lying between the forks of the Shyenne, on the 44th parallel, between the 103d and 105th meridians, cover an area of 6,000 square miles. Their bases are elevated from 2,500 feet to 3,500 feet, and the highest peaks are about 6,700 feet above the ocean level.

The different rocks which compose these mountains, as determined by our exploration, are—

- I. Metamorphosed azoic rock, including granite.
- II. Lower Silurian, (Potsdam sandstone.)
- III. Devonian?
- IV. Carboniferous.
- V. Permian.
- VI. Jurassic.
- VII. Cretaceous.

All the rocks below the Silurian are igneous and metamorphic, and the stratification which they exhibit stands everywhere nearly vertical, with a strike varying between northeast and northwest. So constant is this vertical dip, that it may not in reality indicate primary stratification, but some mechanical arrangement due to the molecular forces brought into existence during its cooling from the heated state. All the rocks, from the Silurian to the close of the Cretaceous, apparently lie conformable to each other. The shape of the mass is elliptical; the direction of the longest line of this or major axis being about north 20° west. On the west the rocks dip, as a whole, very gently, and at a distance of five miles from the foot of the hills the Cretaceous is apparently undisturbed, though at the base these rocks in some places stand at an angle of 45°. The manner in which this rock lies suggests the idea that the Cretaceous probably forms a considerable portion of the elevated plateau between the Black Hills and Big Horn Mountains. The dip of the upheaved rocks on the west side is as a whole very gentle, not amounting to more than from 5° to 15°, and, consequently, they are considerably developed, and form more than one-half the mountain mass composing some very high ridges. These rocks have a much greater inclination on the east side of the mountains, and soon disappear under the Cretaceous, forming a comparatively narrow belt. The east base of the mountains is from 2,000 to 3,000 feet below the western.

The rocks seem also to dip much more suddenly down on the south than on the north side. The strike of these upheaved strata is in almost every direction corresponding, on the exterior, nearly with that of the tangent to the outline of the mass, and on the interior being more nearly coincident with the direction of the major axis.

A result of this formation is that the upturned rocks break off abruptly on the side toward the interior of the mass, and leave an open valley in many places between this steep slope and the gentle one which succeeds it as we approach the interior. In these valleys the best roads are found, and one, which nearly encircles the Black

Hills, is known among the Indians and traders as the Race Course or Running Road.

The Inyan Kara Peak is basaltic, and the appearance through a powerful spy-glass of those to the north, known as the "Bear's Lodge" and "Little Missouri Buttes," indicates that they are also of this formation. More recent volcanic action is visible at Bear's Peak, and two circular spaces to the west of this peak, now occupied by muddy lakes, indicate the existence here in former times of volcanic forces.

The highest mountain masses, such as Harney's Peak, on the east side, are all granite, the rocks, as seen at a distance, appearing in the same unmistakable form as those on the Raw Hide and Laramie Peaks, namely, coarse granite or gneiss, standing in layers and slabs, indicating a vertical stratification. A full description of these mountains must be left for the final report. They derive their name from being covered with pine, whose dark green gives them a black appearance.

In reference to the Carboniferous rocks in these mountains, Dr. Hayden says:

"The exact positions in the Carboniferous system to which the limestones around Fort Laramie and in the Black Hills belong, are not sufficiently clear from the evidence yet obtained. They do not seem to be the equivalents of the beds above described along the Missouri, though they may be. The texture of the rock is quite unlike any of the limestones of the Coal-Measure with which we are acquainted, and there seems to be an absence of the fossils characteristic of the Coal-Measure limestones on the Missouri, and in Northeastern Kansas. The latest opinion, however, of my associate, Mr. Meek, is that they belong to the true Coal-Measures."

In these mountain formations, which border the great plains on the west, are to be found beautiful flowing streams, and small rich valleys covered over with fine grass for hay, and susceptible of cultivation by means of irrigation. Fine timber for fuel and lumber, limestone and good stone for building purposes are here abundant. Gold has been found in places in valuable quantities, and without doubt the more common and useful minerals will be discovered when more minute examinations are made.

I think it exceedingly desirable that something should be done to encourage settlements in the neighborhood of Fort Laramie. The wealth of that country is not properly valued, and the Indian title not being extinguished there is no opportunity to settle it. Those who live there now support themselves by trade with the Indians, which being already overdone, it is to their interest to keep others away. If the Indian title were extinguished, and the protection of the territorial government extended there, so as to be effectual, there would soon spring up a settlement that would rival that of Great Salt Lake. The Laramie River is a beautiful stream, with a fine fertile valley, and there are such everywhere along the base of the mountains. Pine timber, of the finest quality, in abundance grows there, easy of access, from which the finest lumber can be made; building stone of good quality abounds. The establishment of the military post, and the constant passing of emigrants, have driven away the game, so that the Indians do not set a high value on the land, and it could easily be procured from them.

The people now on the extreme frontiers of Nebraska are near the western limit of the fertile portions of the prairie lands, and a desert space separates them from the fertile and desirable region in the western mountains. They are, as it were, on the shore of a sea, up to which

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population and agriculture may advance, and no further. But this gives them much of the value of places along the Atlantic frontier, in view of the future settlements to be formed in the mountains, between which and the present frontier a most valuable trade would exist. The western frontier has always been looking to the east for a market, but as soon as the wave of emigration has passed over the desert portion of the plains, to which the discoveries of gold have already given an impetus that will propel it to the fertile valleys of the Rocky Mountains, then will the present frontier of Kansas and Nebraska become the starting point for all the products of the Mississippi Valley which the population of the mountains will require. We see the effects of it in the benefits which the western frontier of Missouri has received from the Santa Fé trade, and still more plainly in the impetus given to Leavenworth by the operations of the army of Utah in the interior region. This flow of products has, in the last instance, been only in one direction, but when those mountains become settled, as they eventually must, then there will be a reciprocal trade materially beneficial to both.

These settlements in the mountains cannot be agricultural to the same extent as those on the Mississippi Valley, but must depend greatly upon the raising of stock. The country furnishes the means of raising sufficient quantities of grain and vegetables for the use of the inhabitants, and beautiful, healthy, and desirable locations for their homes. The remarkable freedom here from sickness is one of the attractive features of the region, and will, in this respect, go far to recompense the settler from the Mississippi Valley for his loss in the smaller amount of products that can be taken from the soil. The great want of suitable building material which now so seriously retards the growth of the West will not be felt there.

How far the fine timbers in the interior of Nebraska can be relied upon to supply settlements on the Missouri, is a question upon which I am not qualified to give a very positive opinion.

The pine extends along the Niobrara and its side ravines for about 120 miles, and there is nearly an equal extent of it on White River; but on both streams it is of inferior quality and difficult of access. That at the Black Hills is much better timber, and covers an area of about 1,500 square miles; but this is also in situations where there would be much labor in getting it out, and an Indian war would probably attend the first attempts to do so. I think the Niobrara, White, and Shyenne rivers could be used to bring the logs to the Missouri, down which they could be rafted.

The great want of timber which is felt along the settlements on the Missouri, and the high price which this material commands, may probably overcome all the difficulties I have stated to exist; and, having done this as faithfully as I can, I must leave each one to form his own opinion on the subject.

CHAPTER III.

REMARKS ON THE CLIMATE—METEOROLOGY.

The seasons I have spent in Nebraska have, as I am informed by those who have resided there a long time, been favored with an unusual supply of rain. With this caution as to the inferences which may be drawn from our observations, I will give a short account of some of the meteorological phenomena observed by us.

In the year 1855 we left Fort Leavenworth on the 15th of June, and reached Fort Pierre on the 16th of July. During the passage up the river we had 13 days of nearly calm weather; 10 days of south or south-east wind, sometimes very strong; seven thunder-storms, some of them of great violence, with much rain, the amount diminishing as we ascended the river, (there being no heavy rain after the 29th of June, all of which time we were above the mouth of the Niobrara.) The highest temperature observed was on July 15, at 2 p. m., at which time the dry thermometer gave 102° in the shade, and the wet-bulb thermometer 69° . When we reached Fort Pierre we were informed that there had been no rain or snow there for more than a year. The appearance of the vegetation confirmed this statement, as scarcely a green spot was anywhere to be seen.

Hourly observations on the wet and dry bulb thermometers and barometers were made at Fort Pierre from July 17 to 25, and at the hours of 7 a. m., 9, and 2 p. m., till August 7. The mean height of the barometric column at this place is (reduced to 32°) 28.436; the altitude above the sea, 1,500 feet. The highest temperature observed during this time was, at 3 p. m., July 22, dry thermometer, 86° ; wet-bulb thermometer, 64° ; the barometer, reduced to 32° , reading 28.310. On the same evening we had a heavy fall of rain, with thunder and lightning, about 5 miles south of the fort; this was the first rain experienced in the neighborhood. From July 22 to August 7 there were three violent thunder-storms from the west, one of which was attended with a heavy fall of rain. An abundance of rain continued to fall here during the summer.

While on the journey from Fort Pierre to Fort Kearny, between August 7 and August 22, we had much overcast and misty weather nearly all the time, and on seven of the days rain fell in small quantities.

From August 25 to September 12 we were on the road along the Platte River between Fort Kearny and Fort Laramie; during this time we had two heavy thunder-storms, attended with a large fall of rain. While at Fort Laramie, we had heavy frost about the 25th of September. Fort Laramie has an elevation of 4,200 feet.

From September 29 to October 19 we were on the road to Fort Pierre. The weather at times was very cold, and snow fell to the depth of four inches on the night of the 3d of October; for several days in the first part of this month the thermometer stood, at daybreak, at 29° . On the 20th and 21st of October we had a violent storm of rain, sleet, and snow, with high winds, which covered everything with ice. We were quite surprised, on reaching the neighborhood of Fort Pierre, to find the grass green and abundant, for it was such a contrast to its appearance in August, when everything seemed to have perished for want of rain. Much snow fell here during the winter, and in the spring there were heavy showers of rain, so that a more beautiful prairie country could not be found than this, as it appeared in May and June, 1856. At the same time the previous year the grasses scarce gave an indication of life.

We left Fort Pierre on the 28th of June, 1856, and reached Fort Union on the 10th of July; on the passage the weather was comparatively clear, with light winds. Up to this time no rain had fallen there, and in many places there was a great scarcity of grass. On the 15th a heavy storm of rain and wind commenced at 9 p. m., and continued till 10 p. m. on the 17th. The wind for several days previous had been light, and came from the north. On the 15th, at 2 p. m., the thermometer was at 90° , the barometer (reduced to 32°) reading 27.827. At 9 a. m., on the 16th, the barometer read 27.735; thermometer 58° . The

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wind blew with great violence from the north all day on the 16th, so that it was with great difficulty we kept our tents standing; and a portion of the inclosure of the American Fur Company's fort was blown down. This storm was not accompanied by thunder and lightning. On the 17th the weather was again clear; wind light from the northeast; thermometer, at 2 p. m., 67°; barometer, 28.179. Fort Union has an elevation of 1,900 feet above the sea.

While at Fort Union and in the neighborhood we had after this abundance of rain, so that the whole landscape in August and September wore a beautiful green, and grass was plenty in places where, in July, there was not a blade of it. The highest temperature we experienced here was on the 20th of July, the thermometer, at 2 p. m., reading 93°. The earliest frost ever recorded to have occurred here was in the month of August of 1855.

We left Fort Union the 1st of September and reached Fort Pierre on the 5th of October. We were again struck with the variable nature of the climate on finding that but little rain had fallen here during our absence, and the grass had all dried up, though at this place the same period of the previous year it was everywhere green.

In the year of 1857, we started from Omaha the 28th of June, in the midst of the rainy season, and reached Fort Laramie August 20. During this journey we had fifteen rainy days, or about one in four, and on many other days there were showers with thunder and lightning near us that are not included. The highest temperature was 100°, 2 p. m., August 11.

Prior to our arrival at Fort Laramie not much rain had fallen there; but on the 22d it commenced, at 11 a. m., to rain hard, and continued with but little intermission till the 24th. This storm was not accompanied by violent wind, and the barometer gave very little indication of its approach, preserving about a reading of 25.980. No one there remembered to have ever seen so much rain fall at one time at that place.

I left Fort Laramie on the 4th of September; we had one heavy rain on the 10th, at the base of the Black Hills. While in the Black Hills we had a storm that lasted from 6 a. m. on the 16th till 9 p. m. on the 17th. As we were traveling and changed our altitude during this storm while it was coming on, the indications of the barometer are not at all reliable. Our elevation was about 5,500 feet. The storm began with hard rain, thermometer 54°. The temperature gradually fell till the changed to snow during the night of the 16th, and the thermometer went down to 32°. There was a strong wind a portion of the time from the north. During the latter part of this storm we were enveloped in the clouds, and as it cleared up these gradually rose, as we could see by the line they made along the sides of the high peaks and ridges.

We experienced a very violent storm, of about twenty-four hours' duration, on the 8th of October, while on White River, and had a fall of about six inches of snow on the Niobrara on the 18th of October. From the 18th of October to the 31st, we had four storms of rain and sleet.

I have not attempted here to give the direction of the wind during the period, as it could only be done satisfactorily by copying the daily register. The prevailing wind through the year is from the north, as is fully established by the sand-hills along the Niobrara. The wind has blown these up to the brink of the precipices along the north bank, and on the south has removed them to the distance of about half a mile.

October is generally a very windy month. In 1856, fifteen days of this month, while we were traveling down the Missouri in a Mackinac boat, from Fort Pierre to Sioux City, it blew so we could not proceed. The prevailing wind at this time was from the south, and we had one violent rain-storm with a south wind.

A true indication of the nature of the climate of Nebraska is to be found in the character of the plants which grow there. Certain kinds, unable to live through the long periods of drought which occur, are rarely to be seen, and those which flourish best are such as require but little moisture, or whose roots, penetrating deep into the soil, enable them to draw a sufficiency of moisture from below. In the high prairies, where there is a good soil, we find the bunch-grass growing in tufts, but in many places interspersed with patches of cacti. The bottom lands of many of the streams support no trees but the cottonwood and willow, and some of them produce rank growths of the wild sage.

The absence of trees on all the prairie regions is another evidence of the dryness of the climate, and even in places where they can grow, as in the ravines, the excessive cold of the winter winds prevents them from reaching their full development, as is proved by the dead tops of nearly all the trees which extend their branches above the level of the prairie. The prairie fires have done much toward preventing the growth of trees in places adapted to them, but it is not a sufficient cause to account for the general absence of forests.

An interesting instance of the effect of climate on the growth of trees is to be seen in the cedar as you ascend the Missouri. At the first Cedar Island, in latitude 43, these trees grow in the bottom lands of the river, and are large and straight, those growing on the bluffs being of an inferior quality.

The cedars diminish as you ascend, and the last of these in any number together are to be seen in the bluffs opposite the mouth of the Little Shynenne, in about latitude 45, and here they are exceedingly crooked and twisted. Along the Missouri and Yellowstone, in the Lignite Tertiary formation, we find the cedar unable to support itself above the ground, and, spreading itself over the surface, presents the appearance on the hill-sides of grass or moss.

During the time I have been in Nebraska I have found everywhere an abundance of grass, except in places near the posts and others, where it had been eaten off by the buffalo.

A considerable quantity of a small variety of corn is raised by the Mandans, Rees, and Gros Ventres, near the 47th parallel, on the Missouri, and it is probable that this corn can be raised along the base of mountains as far north as the 46th parallel. The entire mountain section of Nebraska will produce good wheat, where the land can be irrigated, and the abundance of grass for pasturage will permit of the raising of immense herds of stock.

This western portion of Nebraska may, therefore, in the future be valuable for occupation for a people partly engaged in agriculture, but relying mainly upon the raising of stock.

Many valuable inferences in regard to the climate may be drawn from an examination of the catalogue of plants growing in Nebraska, prepared by Dr. Hayden, and appended to this report.

It is my intention to give tables of the meteorological observations in a subsequent report. These, besides the indication they afford of the climate of Nebraska, will be useful in aiding the determinations of the progress and limits of storms over large areas in connection with exten-

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sive investigations on this subject carried on by the Smithsonian Institution, under the direction of Professor Henry.

The thunder-storms, so far as we have observed them, have a great uniformity. The day after one has passed over is generally cold, with a light north wind and high state of the barometer. This condition lasts from one to three days, when the wind changes to the south and gradually increases in force during the day, and sometimes falling almost to a calm at night. The barometer falls during the time, and cumulus clouds begin to form. After the south wind has blown three or four days, a thunder-storm comes from the west generally in the night; the south wind often blowing a hurricane all the time the storm is approaching from the west. This storm is again succeeded by cool weather and a high state of the barometer, and in general we found a sure indication of the approach or termination of a storm in the falling or rising of the barometric column. These storms as seen on the prairie have a number of independent centers, so that they often pass across the landscape to the north and south without your receiving any of the rain. They are frequently accompanied by a fall of hail and violent gusts of wind.

CHAPTER IV.

DESCRIPTION OF PRINCIPAL RIVERS AND DISCUSSION OF THE MERITS OF DIFFERENT ROUTES.

In giving a description of the character and importance of the rivers examined, it will perhaps be best to discuss at the same time the subject of routes, as they are intimately connected.

The Missouri, therefore, claims our first attention, and though it has been so repeatedly described by others, a few of its general features may be enumerated here. A detailed account of the various points we examined as locations for military posts must be reserved for the final report. This great stream has generally a uniform width from the junction with the Yellowstone to its mouth, varying from one-third to one-half a mile when the banks are full. In low water the width is much less, and dry bars of sand occupy portions of the bed, from which the water has withdrawn. In the upper part of the river where the trees do not destroy the force of the wind, the sand is blown about in the most astonishing manner, and the clouds of sand can be seen for many miles. Sand-banks are thus formed, generally at the edges of the trees on the islands and points, and which are often many feet above the level of the highest floods.

The force of these winds may be inferred from this, and from their constancy during certain months, especially in October, are of themselves one of the greatest obstacles to the navigation of the river.

The plans which these sand-banks exhibit are those of the perimeters of the islands and points on which they were formed, and not unlike those of the Indian mounds in the Mississippi Valley, which are supposed to be the remains of ancient fortifications. These banks along the Missouri have, therefore, been considered as the works of the aborigines, such, for instance, as those described and figured by Lewis and Clark as existing at Bon Homme Island. I have conclusive evidence, from personal examination, that these were formed by the wind,

and are not the work of the ancient Toltees, as some writers have supposed.

The river has generally, in the same stages of the floods, about as good navigation on account of the depth above James River as it has at that point, but an improvement takes place below this point, in the depth of the water on the sand-bars in low stages, as you descend to its mouth.

Along the banks of the Missouri the bluffs are generally clothed with various species of trees as far up as the mouth of the Platte; above this point the timber is generally confined to the ravines and bottom lands. These bottom lands attain a width of from ten to fifteen miles after we get above Council Bluffs, which is almost continuous to the mouth of James River. Throughout this section the edges of the banks are lined with heavy cottonwood and other trees, and fuel for steamboats can now generally be found cut up and prepared for their use.

At James River the bluffs close in so that the general width of the space between is only from one to two miles all the way to the Upper Big Bend, near the 48th parallel. Here again the bottom lands become wider, and continue at a width of from three to six miles to a point about fifty miles above the Yellowstone. In this last section there is also an abundance of large cottonwood timber, and the appearance of the river is quite similar to what it is at Sioux City. After passing the Niobrara the steamboat's crew will have to cut the wood required for generating steam, and the only scarcity will be in finding dead trees at such points as the boat can land at. Abundance of fuel exists everywhere, if the wood was cut beforehand and hauled to suitable landings. The portion of the river most deficient in wood is between the mouth of the Little Shyenne and Cannon Ball rivers, but even here there is an abundance for the purposes of navigation for years to come.

One of the greatest obstructions to the navigation of the Missouri consists in the great number of snags or trees, whose roots, embedded in the channel by the caving of the banks, stand at various inclinations pointing down the stream. These obstructions are, comparatively, quite rare above the mouth of James River, but from this point down to the Mississippi it is a wonder often how a steamboat can be navigated through them. As it is they cause the boats to lie by during the night, and thus occasion a loss of nearly half of their running time. But this is not the only delay, for often on account of the wind the bends filled with snags cannot be passed, and the vessel is frequently detained for days on this account. This effect of the wind is much more seriously felt as you ascend above Council Bluffs, for the protection afforded by the trees on the banks is constantly diminishing.

Our examinations extended but sixty miles above the mouth of the Yellowstone, but the portion between this and Fort Benton was examined carefully by the parties under Governor Stevens in 1853, and the results are given in his report on the Pacific Railroad explorations. It is the almost universal opinion of those who have examined this portion of the river that it would be navigable in its best stages for light-draught boats. From our reconnaissance in 1856, I feel convinced that, notwithstanding the difficulties to navigation which exist, the Missouri is a superior river to any in this country, except that portion of the Mississippi which is below their junction. The navigation is generally closed by ice at Sioux City by the 10th of November, and at Fort Leavenworth by the 1st of December. The rainy season of the spring and summer

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commences in different years between the 15th of May and the 30th of June (in the latitude of Kansas, Missouri, Iowa, and Southern Nebraska) and lasts about two months. During this period the tributaries of the Missouri in these latitudes maintain this river in good boating stage. The floods produced by the melting snows in the mountains come from the Platte, the Big Shyenne, the Yellowstone, and the Missouri above the Yellowstone, and reach the lower river about the first part of July, and it is mainly on these that the navigator of the Missouri above the Niobrara depends. The length of time the flood lasts is in proportion to the quantity of snow in the mountains, which varies greatly in different years. On the average it may be said to last a month, but a steamer starting from Saint Louis on the first indication there of such rise would not generally reach the Yellowstone before it was nearly past this latter point. Rivers like this, whose navigation depends upon the temporary floods, are greatly inferior for ascending than descending boats. The rise at the Yellowstone would be about ten days reaching Saint Louis, and any good system of telegraphing along the stream, which would apprise those below, would more than double the advantages to the upward navigation. If a miscalculation is made by taking a temporary rise for the main one, the boat has to lay by in the middle part of the river till the main rise comes. From this cause, I, starting on the 16th of April, was thirty-seven days in getting to Fort Pierre, 1,250 miles from Saint Louis. Again, if the boat starts too late, the main rise may all pass the upper river before she reaches it, and her progress will then be slow and tedious. By starting June 6, 1855, (which was too late, it being an early season,) we were forty-one days going to Fort Pierre.

The American Fur Company's boats are of the largest class of freight-boats now navigating the Missouri. They are ably managed, and the company possesses information by expresses sent from its trading posts near the mountains, as to the amount of snow that has fallen and the probable extent and time of the rise produced by its melting. The boats are loaded and time of starting fixed accordingly. Their boats carry from one hundred and fifty to two hundred tons to the Yellowstone, a distance of 1,900 miles, drawing from 3 to 3½ feet of water, and make the passage up in from twenty-two to thirty-five days. Considerable freight is taken out for the post of Fort Union, and they generally ascend with that for Fort Benton to about sixty miles above the mouth of the Yellowstone, and have, on one occasion, gone to Milk River, one hundred miles farther.

The quantity of water is, on the average, about equal from the Yellowstone and Missouri at their junction, and above this point steam-boats venture with caution. The great risk, in proceeding farther, of having the boat caught in the upper river during the winter, more than counterbalances the prospective gain. The freight is then taken on board of Mackinac boats and corded by hand, aided generally by sails. These boats are from 60 to 70 feet long, drawing 15 to 18 inches, (regulated somewhat by the cordeling force,) though 20 to 24 inches draught could be used. The time from Fort Union to Fort Benton varies from forty to eighty days, depending on various causes, of which wind is the most important. The river distance from Milk River to Fort Benton is about five hundred miles.

The interests of the General Government would be much advanced by making appropriations to remove the snags which obstruct the river below James River.

The Yellowstone.—For the first one hundred miles above the mouth, the bottom lands are nearly all on the left bank; and the first forty

miles are from four to five miles broad, with beautiful, soft, rounded bluffs to the west; the banks of the river are clothed with large cottonwood trees, and the country presents one of the finest locations for a military post and Indian reservation anywhere to be found. After you advance about forty miles up the left bank, the bluffs begin to come on this side almost to the river, and the bottom lands narrow and the timber diminishes. A good route for wagons, however, exists on this side for one hundred miles above the mouth. Having gone thus far you meet with very impracticable bluffs, barely permitting of the passage of pack mules, to get around which with wagons, without crossing the Yellowstone, you must travel out into the prairie one or two days' journey, so as to head the difficult ravines. Bluffs similar to these exist on the right bank all the way from the mouth to this place, but here the river suddenly changes its position in the valley, so as to leave the open valley on the right bank, and causes the difficulty which exists on the other.

This point is also the highest point navigable for steamboats, and those even of very light draught cannot, except at high water, go further than about fifty miles from the mouth, as, in the next space of fifty miles, the channel is so very much divided up by wooded islands and obstructed by gravel-bars. But at the point before mentioned as the head of steamboat navigation, ledges of rock begin in the bed of the stream, and about one-half mile below Powder River we encounter a dangerous rapid, called by Captain Clark "Wolf Rapid." Two miles above Powder River, Captain Clark describes another serious rapid, which he calls "Bear Rapid;" and twenty miles above this another, which he calls "Buffalo Shoal," and which he speaks of as being "the most difficult part of the Yellowstone River." All these rapids are passed every year by the Mackinac boats of the American Fur Company on their way to Fort Alexander Sarpie, and there are probably no obstacles sufficient to prevent them from reaching the point where this river debouches from the mountains.

The valley, all the way to the mountains, is said to be practicable for wagons. Above this point the river is said to be much inclosed by the mountains, which are rugged and difficult, and covered with pine forests.

From Fort Union to Fort Alexander Sarpie, on the Yellowstone, the Mackinac boats are from 50 to 60 feet long, drawing from 15 to 20 inches water, and make the distance, 225 miles, in from fifteen to thirty days.

None of the tributaries of the Yellowstone, (Clark's Fork, Big Horn, Tongue, and Powder rivers,) above their mouths, have ever been visited by any exploring expedition, except those of trappers and hunters.

The Big Horn River is by far the most important of those streams, and has been navigated by the traders in skin boats, carrying their peltries, from the point where it debouches from the Big Horn Mountains to the Yellowstone, a distance of perhaps 150 miles. Above where the stream escapes the mountains, it is not navigable for anything but the smallest boats, and the gorges by which the stream passes the mountain range is impracticable for any kind of land transportation; a considerable detour being required even for pack animals. The portion navigable will, perhaps, according to the opinion of Colonel Robert Campbell, of Saint Louis, furnish a depth of water for Mackinac boats, in high stages, of about 18 inches, but he thinks the navigation of this stream for ascending boats could not be used to any advantage. An undue importance has been given to the navigability of this stream from the erroneous position of the Yellowstone, as laid down on nearly all recent maps, except those from this office, as they make its position

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Powder River.—This stream rises near the southern point of the Big Horn Mountains, and flows a little east of north. The route from the Platte to the Yellowstone along the stream is practicable, but as a route for wagons it is difficult, requiring the stream to be frequently crossed, and the banks are very muddy, and the bed is occupied in places by quicksand.

The Little Missouri River rises near the North Fork of the Shyenne in longitude 105°. I have seen the country near its source, where it forms the northern part of the upheaved stratified rocks of the Black Hills, and at the mouth where the Lignite Tertiary exists. Its general direction is northeast, and its course through the main portion must be in this Lignite Tertiary formation. From the statements of members of Sir George Gore's party, which traveled up the stream in 1856, I infer that the route along or near its valley is practicable for wagons, though difficult. The valley is one of the great buffalo regions.

The Knife River, Heart River, Cannon Ball River, Grand and Moreau rivers, all rise in the prairie ridge east of the Little Missouri, and they contain but little water in the winter and latter part of summer. I have never seen any of them, except at their mouths, and their lengths on my map indicate their comparative size.

The Big Shyenne is a most important river, and has its extreme sources west of the Black Hills, which its two main branches inclose. These forks are supplied by numerous streams from the mountains, and they unite in about longitude 102° 20', the river flowing into the Missouri in latitude 44° 48'. In its lower course I am informed there is fertile land on its banks, and there are considerable areas in and around the Black Hills. The Shyenne River can probably be rafted, and the streams that come from the hills could be used to drive the logs down to the river. It must be borne in mind that the pine growing on the Black Hills is difficult of access, and the expense of getting it out may render this fine supply of timber unavailable to the Lower Missouri. The Missouri at the mouth of the Shyenne is in the center of the Dakota country, and along its valley we have the shortest and best route by which to reach their strongholds.

Bad River, Wakpa Spicha, (sometimes called Teton River,) receives its name from the unpalatable state of its water in low stages, and the difficulty of traveling along it in wet weather. It lies throughout in the black-shale bed of the Cretaceous formation. It is along the sources of its northern branches that the road from Fort Pierre to Fort Laramie is located.

White River, or White-Earth River, (Mankisita Wakpa, or Smoking-Earth River,) has generally an open, well-wooded valley, with a fine soil and luxuriant grass. The road between Forts Laramie and Pierre follows the valley from its source to the Bad Lands, where the river enters a difficult section bounded with precipices like those on the Niobrara. The Bad Lands extend continuously down the stream to the South Fork, a distance of about seventy miles. Below this, the river winds through a handsome, well-wooded valley of the Missouri. Any one who travels in Nebraska will always feel rejoiced when he reaches the banks of this beautiful stream. It is much resorted to by the Brulés. It has numerous branches, the largest of which is called the South Fork. The pine on White River and its tributaries is nearly equal in extent to that on the Niobrara. This stream has been used by the traders to float

down their peltries by means of skin boats from their former trading-house near Butte Cache. I believe it can also be used to raft down the pine timber on the South Fork.

The *Niobrara* being a stream heretofore unknown, and one in which the people of Nebraska feel much interest, I shall describe it in detail. This river is about three hundred and fifty miles long. From its source to longitude $103^{\circ} 15'$ it is a beautiful little stream of clear running water, of a width of from ten to fifteen feet, gradually widening as it descends. Its valley furnishes here very good grass, abounding in rushes or prele, but is for the most part destitute of wood even for cooking. After flowing thus far it rapidly widens, till in longitude $102^{\circ} 30'$ it attains a width of sixty to eighty yards; its valley is still quite open and easy to travel along, but destitute of wood, except occasional pines on the distant hills to the north. In longitude $102^{\circ} 30'$ it enters between high, steep banks, which closely confine it, and for a long way it is a complete cañon; here, however, wood becomes more abundant and pine is occasionally seen on the bluffs, while small clusters of cottonwood, elm, and ash occupy the narrow points left by its windings. In longitude $101^{\circ} 45'$ the sand-hills come, on the north side, close to the river, while on the south side they are at the distance of from one to two miles off, leaving a smooth road to travel on along the bluffs. The bluffs gradually appear higher and higher above the stream as it descends until they reach the height of three hundred feet. The sand mostly ceases, on the north side, in longitude $100^{\circ} 23'$; but it lies close to the stream, on the south side, nearly all the way to the Wazi-honska. Throughout this section, lying between longitude $102^{\circ} 00'$ and longitude $99^{\circ} 20'$, a distance of one hundred and eighty miles, the *Niobrara* is in every respect a peculiar stream, and there is none that I know of that it can be compared with. It flows here between high, rocky banks of soft white and yellowish calcareous and siliceous sandstone, standing often in precipices at the water's edge, its verticality being preserved by a capping of hard grit. It is here impossible to travel any considerable distance along its immediate banks without having frequently to climb the ridges which rise sometimes perpendicularly from the stream. As you approach from the north or south there are no indications of a river till you come within two or three miles of the banks, and then only by the trees whose tops occasionally rise above the ravines in which they grow, so completely is it walled in by the high bluffs which inclose its narrow valley. It seems as if it had resulted from a fissure in the earth's crust, and now flows at a depth of about three hundred feet below the general level of the prairie. The soft rock which forms the bluffs is worn into the most intricate labyrinths by the little streams, all of which have their sources in beautiful gushing springs of clear cold water. In these small, deep valleys the grass is luxuriant; pine, ash, and oak are abundant. To the agriculturist this section has, however, comparatively little attraction, and that between longitude $99^{\circ} 20'$ and the mouth, an extent of about ninety miles, is perhaps far more valuable. Here the bottoms will probably average a width of a quarter of a mile, are susceptible of cultivation, and cottonwood, oak, walnut, and ash will furnish settlements with all the timber and fuel they will need. The river banks seem to present no good building stone, nor did we, though searching diligently, discover any signs of coal or other valuable minerals.

In describing the tributaries to the *Niobrara*, I shall begin at the mouth and take the north side first. The Ponka River, which has a very fine, well-wooded, and fertile valley, runs into the Missouri about five miles north of the *Niobrara*, in latitude $42^{\circ} 48'$ north. Its course

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is parallel and near to that of the Niobrara as far up as the mouth or Turtle Hill River.

Turtle Hill River (Keya Paha Wakpa) is the main branch of the Niobrara, and is about one hundred and twenty miles long. Prior to the publication of my report and map of reconnaissances in 1855, this branch was represented erroneously as being equal to the main river, in size, above their junction.

I crossed it in 1855, sixty miles below its mouth, and it has a very fine valley, one-half to three-quarters of a mile wide, with good soil and a limited quantity of cottonwood timber. The bed of the stream is sandy, and its waters are clear and sweet; width at the mouth fifty yards. The first twenty miles of the space between this branch and the main river is occupied by sand-hills.

The next northern branch which joins the Niobrara, in longitude $100^{\circ} 23'$, is named Mini-cha-duza-Wakpa, or Rapid Creek. At its mouth it is about eight yards wide, with a valley about a quarter to half a mile wide, and a soil quite fertile; the banks are scantily fringed with small trees. It forms about the eastern border of the sand-hills on the north side of the Niobrara, as far as we could see. Its length is about fifty miles.

There are numerous ravines with steep rocky banks, containing springs and running streams, extending out from five to seven miles between this branch and the Keya Paha, at the heads of which occasionally good camping-places may be found.

The mouth of the next stream is in longitude $101^{\circ} 18'$; it has scarcely any appreciable valley, and flows between high rocky bluffs difficult to ascend and descend; it is about five yards wide, with clear, deep, swift-running water, and is probably about 35 miles long.

The mouth of the next northern tributary is in longitude $101^{\circ} 30'$, and is called White-Earth Creek; it is about three-fourths the size of Rapid Creek, which it resembles in every particular, and is about 25 miles long. The next, in longitude 102° , is a small spring rivulet about 26 miles long, and above this the branches are all small runs coming from the bluffs, generally dry except after rains, with scarcely any valleys to speak of.

On the south side of the Niobrara there are numerous small branches coming in between its junction with the Missouri and the point where it receives the waters of the Turtle Hill River. Three of these are of considerable size, probably 35 miles long, the bluffs along nearly all of them being more or less covered with scattered pine, and their valleys occupied with clumps of cottonwood, oak, ash, &c. The position of the Elk Horn River, about 30 miles south of the Niobrara, prevents any of these southern branches having a length greater than I have stated. From the mouth of Turtle Hill River to that of the Wazi-honska there are still a greater number of short southern branches, all containing springs of water, and abounding in pine and beautiful oak groves.

Wazi-honska means, in the Dakota language, "the place where the pine extends far out;" and this stream, whose mouth is in longitude 100° , is probably 40 miles long, and all its bluffs and side ravines are green with pine. Its valley, though not so wide, is very similar to that of the Niobrara in this part, which has been described.

Suake River, whose mouth is in longitude $100^{\circ} 45'$, is quite a large stream, some thirty yards wide, its bluffs covered with pine, with a narrow valley like the Wazi-honska.

Above this there is scarcely any branch coming in from the south deserving mention.

Niobrara is a very shallow and "swift-flowing stream," as the Canadians say "l'Eau qui Court," abounding in rapids in two-thirds of its upper course, and in its middle portion filled with small islands. In the lower portion its width exceeds that of the Missouri River, and is spread out over sand-bars. The bed in the broad portions is quicksand and difficult to ford. Its waters rapidly increase in volume through its middle portion, from the multitude of springs and streamlets that constantly flow into it from the foot of the bluffs and out of the ravines.

The traders of the American Fur Company have navigated it with skin boats, carrying peltries from their former trading-house near Snake River, and the stream might permit of rafting if the timber should be found of quality, and quantity, and accessibility to defray the expenses. I cannot, however, look upon it as capable of furnishing timber for the country on the Missouri, for the reason that much of the pine is too small, crooked, and knotty, and grows in places difficult to transport it from. The species is what is called the Rocky Mountain pine, has a yellowish-white appearance, and abounds in resin. The distance on the Niobrara over which these pine ravines extend is about 120 miles.

A road could not be made on the bottom lands of the Niobrara; it must keep out on the high prairie so as to head the ravines. From the mouth to Turtle Hill River it would take the narrow divide between the Niobrara and Ponka Rivers. It should remain on the north side of Turtle Hill River from 20 to 30 miles farther, and then cross that stream, as it would thus avoid the sand at the junction of the Niobrara and Turtle-Hill rivers, and cross the latter where there is a better ford or narrower stream to bridge. Turning then toward the Niobrara, this river must be crossed in longitude $101^{\circ} 20'$ to avoid the sand-hills, and the route must continue on the south side to about longitude 102° , when it should again cross to the north side. These crossings for a wagon-road could easily be made at a ford or by bridging, but a proper bridge for a railroad-crossing at these places would be a stupendous undertaking; for, on account of the nature of the banks and ravines, good approaches could not be found so as to descend to the level of the stream, and the bridge would have to be built very high. From longitude 102° west there are no difficulties, beyond a scarcity of wood, in reaching Fort Laramie, or continuing direct to the South Pass, and in this course abundance of excellent pine would be found near Raw Hide Peak.

A preferable road might be found by continuing up Turtle Hill River to its source, and then along the divide between Niobrara and White Rivers, striking the former stream in longitude 102° ; but these divides are generally bad for wagon-routes, on account of scarcity of water, and it is not certain that we would by that route avoid the sand-hills.

I consider the north side of the Niobrara superior to the other for a road for the first 90 miles above the mouth, as the greater number of streams coming in at the south side would occasion considerable detours in gaining good crossing-places and approaches. The portion of the river flowing through the sand-hill region has the sand on the south side generally for one-half a mile, blown away by the wind, leaving a smooth route. On the north side these hills are crowning the very edges of the precipices that rise from the river, and cannot be avoided. The evidence that this difference between the two sides was due to the wind is very complete, and shows that the prevailing winds blow much more from the north here than from the south.

The Elk Horn River rises in about longitude 99° , about 25 miles south of the Niobrara River. Its general course is southeast, and it empties

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into the Platte. As far up as I have seen it, which is in latitude 42° , it has a broad, fertile, and well-wooded valley. Where crossed by Lieutenant Smith in 1855, nearly south from Fort Randall, it is described by him as "a beautiful creek of clear water, with well-timbered banks and firm sandy bottom."

The valley of the Loup Fork is broad, fertile, and well wooded up as far as the old Pawnee villages, a distance of about 80 miles. Above this the valley begins to grow sandy and wood more scarce, and about the meridian of 100° becomes worthless. An occasional farm-site could, however, be found almost to its head. Near its source it flows through high rocky precipices similar to those on the Niobrara; but its source is in the open and desolate sand-hills, a miserable region, impassable for ordinary wagon-trains, and by all means to be avoided. The same remark is true of its main north branch and of Calamus River, and probably of the south branch.

The Platte River is the most important tributary of the Missouri in the region under consideration, and its broad and grass-covered valley, leading to the west, furnishes one of the best wagon-roads of its length in America. From its mouth to the forks, the bluffs are from two to five miles from the water, making an intermediate bottom-valley of from four to eight miles wide. From the forks to Fort Laramie the bluffs occasionally come down to the water's edge, and the road has to cross the points of the ridges. From Ash Hollow to Fort Laramie the road is sometimes heavy with sand. Fine cottonwood grows along the banks and on the islands, from the mouth to Fort Kearney; from here up it is scarce and of small size. Cedar is found in the ravines of the bluffs in the neighborhood of the forks and above. The river is about a mile wide and flows over a sandy bottom. When the banks are full it is about six feet deep throughout, having a remarkably level bed; but it is of no use for navigation, as the bed is so broad that the water seldom attains sufficient depth, and then the rise is of short duration.

The streams of the prairies below the Yellowstone, flowing into the Missouri River, are none of them navigable to any reliable extent; and as most of them run from west to east, their greatest practical value is in affording the land route of communication between our present western settlements and those to be formed in the mountains. Their valleys furnish us the only routes by which to traverse the intervening desert, for here only are such supplies of water to be found as are required, and here, too, is the only soil that can be cultivated, and such scanty supplies of wood as the region produces.

Of all the valleys of rivers running into the Missouri, that of the Platte furnishes the best route for any kind of a road leading to the interior, and the best point of starting is the vicinity of Omaha City. An appropriation of \$50,000 has been expended on bridges, &c., on the eastern portion of it, and the only important improvement remaining to make it far superior to any route on the south side of the Platte is the establishment of a good crossing of Loup Fork, either by bridge or ferry, both of which are difficult: the first on account of the width of the stream—1,900 yards; and the latter on account of the shoals and shifting sand-bars. The ford is bad, by reason of quicksands. Twenty-five thousand dollars would probably make a good crossing to this stream, as the place is within the limit of the settlements. No road improvement in the West would be of greater value to the emigrant or to military operations; and this once done the route would not only be the shortest one in this latitude from the Missouri to the mountains, but would not throughout have one serious obstacle all the

way to the South Pass. Any route that takes the south side of the Platte River has the South Fork to cross, (which is about as difficult a stream as the Loup Fork,) at a point where bridging it or establishing a ferry is, at this time, impracticable; the road then, along the North Fork, has bad places at Ash Hollow and Scott's Bluffs, and has to cross the Laramie River and the North Fork of the Platte by bridges, over which the emigrant must pay toll. The route by the north side of the Platte crossing the Loup Fork is, therefore, of particular value, especially for early travel in the spring, when the streams are generally high.

I have spoken of the locality of Omaha being, in my opinion, superior to any other as a point from which to supply the interior portions of the country along the Platte. This in a measure depends upon the improvements being made of the crossing of Loup Fork. To present Nebraska City is a point presenting almost as short a road which could be made quite so if bridges were placed over a few small streams, and which could be done at an expense to the General Government of not more than \$20,000. A considerable distance of river transportation would also be saved to stores brought from Saint Louis by selecting Nebraska City instead of Omaha. Besides, the first mentioned must always be a superior point from which to supply Fort Kearney. The cost of river transportation to this point is about 75 cents per 100 pounds. The distance from Nebraska City to Fort Laramie, by the proposed improved route, is about five hundred and twenty-five miles. From Fort Leavenworth to Fort Laramie it is about six hundred and forty-five miles.

The price paid for transportation, by the Quartermaster's Department, on these roads, is about \$1.50 per 100 pounds per hundred miles.

It will thus be seen that the transportation of stores to Fort Laramie, by the route from Nebraska City, would be a saving over that from Fort Leavenworth of about \$1.55 per 100 pounds. The total expense from Saint Louis via Nebraska City would thus be \$8.62½ per 100 pounds, and I shall use this route in making a comparison of the advantages offered by any route to the north of it.

The first place which apparently offers a superior route is the neighborhood of Fort Randall. Stores can be delivered at this point from Saint Louis at a cost of about \$2.25 per 100 pounds. The distance to Fort Laramie is about three hundred and eighty miles, which, at the rate of \$1.50 per 100 pounds per hundred miles, would give a total cost of about \$7.95 per 100 pounds, which would apparently indicate a saving over the Nebraska City route of \$0.67 per 100 pounds. There are two reasons, however, why this advantage is practically not now attainable: first, the neighborhood of Fort Randall, as a depot for supplies, men, and animals, is not to be compared with Nebraska City, the former being in a comparatively barren country destitute of inhabitants, and where the necessary store-houses can only be constructed at an expense not less than \$100,000; second, the great difficulties of the route from Fort Randall west. That it is practicable to take wagons along the Niobrara is shown by our expedition in 1857. The wagons were loaded with about 2,000 pounds, and drawn by eight good mules to each.

Our time of traveling from Fort Laramie to Fort Randall, counting the days necessary to stop to rest the animals, was thirty days. About one hundred miles of this route was through sand-hills, where I do not think the ordinary transportation trains could have traveled except in the slowest and most fatiguing manner.

The route I have already indicated on the south side of the Niobrara, in my description of that stream, would be preferable to the one we

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traveled, on account of the sand, but the difficulty of crossing the river would counterbalance the advantage gained by so doing.

The route between Sioux City and Fort Randall is a very good one, and an appropriation of \$10,000 should be made to bridge the Vermilion, for the use of the troops at the fort in hauling supplies from the settlements in Iowa.

This route, and that by the Niobrara, would seem to be the most direct and proper one by which to continue the military road from Mendota to the mouth of the Big Sioux, westward to the South Pass. But the great difficulties of the Niobrara route, and the impracticability of any between it and the Platte, determine me to advise its location direct from Sioux City to the mouth of the Loup Fork.

The road this way, and thence along the Platte Valley, will only be about forty miles longer than by way of the Niobrara. A bridge is required over Middle Creek, at a cost of \$5,000; one over the Elk Horn, at a cost of \$20,000; and one over the Loup Fork, at a cost of \$50,000. A good crossing for the Loup Fork could be made for \$25,000.

The next point on the Missouri which claims attention, as one from which to supply Fort Laramie, is the vicinity of old Fort Lookout. A route from this point should keep north of the White River, and intersect the present road from Pierre to Laramie. The eastern portion of the route I have only examined in part, but feel confident that it is a good one, except for about thirty miles through the Bad Lands, in which I have no doubt a route could be found that, with some improvement, would be equal to the corresponding part of the Pierre and Laramie route.

The route west of this would then be the excellent one along the valley of White River, at the head of which a difficult section of about twelve miles needs considerable improvement. This route would be about three hundred and sixty miles from the Missouri to Fort Laramie, and deserves especial consideration as being the proper continuation of the route located between the Missouri and Fort Ripley under the Interior Department, with the design of being continued to the South Pass. Stores can be delivered at Fort Lookout for about \$3 per hundred pounds.

The route from Fort Pierre to Fort Laramie is one that has long been in use, and is about three hundred and twenty-three miles long. Stores can be delivered here for about \$3.50 per hundred pounds. I think it probable, as settlements advance up the Missouri, and Nebraska and Iowa and Dakota become populated, this route, or the one starting from Fort Lookout, will claim attention.

At Fort Pierre the navigable portion of the Missouri is at its nearest point to Laramie and the South Pass, and above it, of course, there are no competing routes for supplying this section. Neither does the nearest navigable point for steamboats on the Yellowstone or its tributaries offer any route whose diminished length would compensate for the increased river transportation. It is believed that any route which keeps east of the Big Horn Mountains is practicable for wagons between the Yellowstone and Missouri, and that the direct route between Fort Laramie and Fort Benton is favorable to military movements.

In consideration of the best routes for supplying the interior, I have mainly had in view the wants of present occupation of the country. When the habitable portions of Nebraska become occupied, as they eventually will, other routes will become important from causes not now operating and that cannot be foreseen; but I believe that those which are now most important will still maintain the ascendancy from the

effect of natural causes and the structure of the country. The same routes now most used and best adapted to the wants of military occupation were long before used by the trader, the Indian, and the buffalo, as best adapted to their wants; and when future requirements shall demand increased facilities of transportation and locomotion, and railroads shall be built, then they, too, will be found near the main routes now traveled by the trains of the emigrant and the army.

As I before stated, an irreclaimable desert of two hundred to four hundred miles in width separates the points capable of settlement in the east from those on the mountains in the west. Without doubt these mountain regions will yet be inhabited by civilized men, and the communication with the east will require railroads, independent of the want of an interior overland route to the Pacific. For this purpose the valley of the Platte offers a route not surpassed for natural gradients by any in the world, and very little more is to be done west of the Missouri than to make the superstructure. A cheap road for light trains and engines could easily be built, and when settlements are formed in the mountains will become profitable; and the gold that has been discovered there in valuable quantities may produce this result much sooner than we anticipate. The Niobrara apparently presents a more short and direct route to the interior than the Platte, but its natural features are not so favorable. The direct route from Sioux City to Fort Laramie by the Niobrara would be, for a railroad, about forty miles shorter than by way of the Platte and Fort Kearney.

I do not, however, consider the route by the Niobrara as impracticable, but think that the difficulties in the way of constructing it will overbalance the advantages of being a shorter route from the Missouri. If the route be considered as starting at the city of Chicago, thence via Rock Island, Omaha, and the Platte Valley, the distance is about the same as that by Dubuque, Sioux City, and the Niobrara; the one large bend which the former makes at Fort Kearney being counterbalanced by the number of small ones of the latter.

A route for a railroad to the Pacific from the neighborhood of Saint Paul, by way of the South Pass, would keep on or near the general course of the wagon-road lately laid out by Colonel Nobles to the Missouri, at Fort Lookout, and thence along the north side of White River, as before indicated.

Should a route ever be required from the west shore of Lake Superior to the South Pass, it could be located on a very direct and practicable line, via Fort Ripley, Lake Traverse, and the Big Shyenne, and deserves examination.

But a route from Lake Superior west to the South Pass would probably not compete in advantages with that examined by Governor Stevens near the 49th parallel. It may, however, be questionable whether one of equally as many advantages could not be found by proceeding directly west from the Bois de Sioux to the Missouri at Fort Clark; thence by way of Knife River to the Yellowstone River at the mouth of Powder River. The valley of the Yellowstone then offers a direct route west to the mountains, where Captain Clark crossed them in 1806, and thence near the route he pursued to the Bitter Root Valley. The more direct route would be down the valley of the Salmon River; but the information we possess of this stream indicates its character through the mountains to be one of great difficulty.

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CHAPTER V.

INDIANS—MILITARY POSTS—ROUTES FOR MILITARY OPERATIONS, ETC.

I shall here repeat, with some additions, the account of the Dakotas given in my report of explorations in 1855.* The Dakotas are scattered over an immense territory, extending from the Mississippi on the east to the Black Hills on the west, and from the forks of the Platte on the south to Devil's Lake on the north. They say their name means "leagued" or "allied," and they sometimes speak of themselves as the "Ocheti Shaowni," or "Seven Council Fires." These are the seven principal bands which compose the nation, viz :

1. The Mde-wakan-tonwans, meaning "Village of the Spirit Lake."
2. Wah-pe-kutes, meaning "Leaf-Shooters."
3. Wah-pe-tonwans, meaning "Village in the Leaves."
4. Sisi-tonwans, meaning "Village of the Marsh."

These four constitute the Mississippi and Minnesota Dakotas, and are called by those on the Missouri "Isanties." They are estimated at 6,200 souls. Some of these on the Mississippi have long been in contact with the white settlements, and having sold much of their lands to the Government, have abandoned many of their former habits and cultivated the soil. Communities have been formed which have made some approach toward civilization; others of them still live principally by the fruits of the chase in their primitive wildness, and have of late years occasioned much trouble to the settlers of Northern Iowa. It was they who committed the murders last winter on Spirit Lake.

5. Ihanktonwans, (Yanktons,) "Village at the End." These are sometimes called Wichiyela, meaning "First Nation." They are found at the mouth of the Big Sioux and between it and the Missouri River, as high up as Fort Lookout, and on the opposite bank of the Missouri. They are supposed to number 360 lodges. Contact with the whites has considerably degenerated them, and their distance from the present buffalo ranges renders them comparatively poor. A treaty has been made with them, by which they have ceded most of their land to the United States.

6. Ihanktonwannas, (Yauktonnas,) meaning one of the "End Village" bands. They range between James River and the Missouri, as high up as Devil's Lake, number about 800 lodges, and are spirited and warlike, and will give much trouble to the settlers in Dakota Territory. They suffered severely from the ravages of the small-pox in the winter of 1856 and 1857. A small portion, under a chief called Little Soldier, live in dirt lodges during the summer. From the Wazikute branch of this band the Assinniboinas, or Hobe of the Dakotas, are said to have sprung.

7. The Titonwans, "Village of the Prairie," are supposed to constitute more than one-half of the whole Dakota Nation. They live on the western side of the Missouri, and extend west to the dividing ridge between the Little Missouri and Powder Rivers, and thence south on a line near the 106th meridian. They are allied by marriage with the Shyennes, but are enemies of the Pawnees and Crows. The Titonwans, except a

* I am largely indebted for the following description to the "Dakota Grammar and Dictionary," one of the volumes of the Smithsonian Contributions to Knowledge, published in June, 1852, by the Smithsonian Institution, Professor Joseph Henry, Secretary. It was edited by Rev. S. E. Riggs, A. M., missionary for the American Board of Foreign Missions, under the patronage of the Historical Society of Minnesota. Also to the letter of G. A. Balcourt, missionary priest, published with the report of Bvt. Maj. Samuel Wood, Sixth United States Infantry, in 1850.—(See H. Ex. Doc. No. 51, 31st Cong., 1st sess.)

few of the Brulés, on White River, and some of the families connected with the whites by marriage, have never planted corn. They are divided into seven principal bands, viz :

1. Unkpapas, "they who camp by themselves." They roam from the Big Shyenne up to the Yellowstone, and west to the Black Hills; to this band Mato Chiqukesa, or the Bear's Rib, belongs, who was made by General Harney the first chief of the Dakotas. They number about 365 lodges.

2. Sihasapas, (Blackfeet.) Haunts and homes same as the Unkpapas. They number 165 lodges. These two bands have very little respect for the power of the whites.

3. Itazipchos, (Sans Arc, "no bows.") Roam over nearly the same territory as the Unkpapas. They number about 170 lodges. It is difficult to say how these bands received their present names; the Itazipchos being as well provided with bows as any other band, and use them as skillfully.

4. Minikanyes or Minni-kan-jous, (meaning "they who plant by the water.") They number about 200 lodges, and roam principally from the Black Hills south to the Platte. They are generally well disposed toward the whites.

5. Ogallalas or Okandandas. They number about 460 lodges, and are generally to be found on or near the Platte near Fort Laramie. They are the most friendly disposed toward the whites of all the Tetonwans.

6. Sichangus, (meaning Burnt Thighs,) Brulés. They number about 380 lodges, and live on the Niobrara and White Rivers, and range from the Platte to the Shyenne. They include the Wazazhas, to which belonged Matoiya, (the Scattering Bear,) made chief of all the Dakotas by Colonel Mitchell of the Indian Bureau, and who was killed by Lieutenant Grattan.

7. Oo-he-non-pas, (Two Boilings, or Two Kettle band.) These are now very much scattered among other bands. They number about 100 lodges. Some of them are generally to be found in the neighborhood of Fort Pierre.

The Dakotas, on and west of the Missouri, which includes all but the Isanties, are the only ones I have heard estimated. I should think eight inmates to a lodge, and one-fifth of them warriors, an ample allowance. We would then have—

Name of band.	Lodges.	Inmates.	Warriors.
Ihanktonwans, (Yanktons).....	360	2,880	576
Ihanktonwannas, (Yanktonais).....	800	6,400	1,280
Unkpapas.....	365	2,920	581
Sihasapas, (Blackfeet).....	165	1,320	264
Itazipchos, (Sans Arc).....	170	1,360	272
Mini-kan-jous.....	200	1,600	320
Ogallalas.....	460	3,680	736
Sichangus, (Brulés).....	380	3,040	616
Oo-he-non-pas, (Two Kettles).....	100	800	160
	3,000	24,000	4,800

In the summer the Dakotas follow the buffaloes in their range over the prairie, and in the winter fix their lodges in the clusters or fringes of wood along the banks of the lakes and streams. The bark of the cottonwood furnishes food for their horses during the winter snows, and

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1,600	320
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to obtain it many streams have been thinned or entirely stripped of their former beautiful groves. Their horses are obtained by traffic with the Indians farther south, who have stolen them in New Mexico, or caught them wild on the plains toward the Rocky Mountains; considerable numbers are also raised by themselves. The nation is one of the most skillful and warlike, and most numerous in our territory, and could they be made to feel more confidence in their own powers, would be most formidable warriors. In single combat on horseback they have no superiors, a skill acquired by constant practice with their bows and arrows and lances, with which they succeed in killing their game at full speed. The rapidity with which they shoot their arrows, and the accuracy of their aim, rivals that of a practiced hand with the revolver. Notwithstanding the destruction of their numbers by small-pox and cholera, it is the opinion of some that they are increasing in numbers rather than diminishing, except where they mingle with the settlements on the frontier.

These Dakotas formerly all lived around the headwaters of the Mississippi and Red River of the North, and in their migration to the southwest have been preceded by the Shyennes, (with whom they are on friendly terms,) who have given their name to the Shyenne of Red River, to the Big Shyenne of the Missouri, and to the section of country they now occupy between the Platte and the Arkansas. The Dakotas then lived on much of the land now occupied by the Chippewas, and the Chippewas at that time inhabited the region between the Sault Ste. Marie and Lake Winnepeg, the Crees, their allies, occupying that from Lake Winnepeg and other lakes as far as Kis-is-kad-ji-wan (Saskatchewan River) and toward the Assiniboin River. The plains to the south of the last stream were the scene of many contentions and bloody combats, nevertheless, oftener the residence of the Dakotas than of the other two tribes, until that nation was divided into two bodies, originating in jealousy of the women, which ended in their being irreconcilable enemies to this day. The less powerful and flying party took refuge in the rocky precipices of the Lake of the Woods, and received from the Chippewas the name of Assiniboins, or Dakotas of the Rocks, under which name they are now generally known to the whites. They, however, retain among themselves the name Dakotas, and speak that language. The other Dakotas, in speaking of them, always call them *hohé*, or enemies.

The Assiniboins then allied themselves with the Chippewas and Crees and forced the Dakotas to abandon all the country north of the Shyenne, which is now regarded as the boundary between these tribes.

The Chippewas, Crees, and Assiniboins are friendly to each other and united in their hostility to the Dakotas, and it is improbable that any lasting peace can ever be effected between them. The common war ground is the region about Lake Minniwaken, to which they all repair to hunt buffalo. The Assiniboins and Crees may yet occasion us no little difficulty, as a large portion of their lands is in the British territory. They both are now well disposed and friendly. I saw them while at Fort Union in 1856, and they were particular to inform us that they did not want to sell their land, and could not spare any of what they now occupy.

These Indians have comparatively few horses, and rely largely on dogs, of which they have great numbers, for transportation. The flesh of these animals also serves them as food. The Assiniboins number about 450 lodges, or 3,600 souls. They suffered severely from the small-

pox in 1856-'57. Their country extends from the Red River west along the Missouri as far as the mouth of the Milk River.

The Absarakos or Crows occupy the country about the Yellowstone and its branches, being bounded on the east by the Dakotas, south by the Platte, and west by the dividing line between the waters of the Atlantic and Pacific.

Their country abounds with everything Indian life requires, and they are generally well disposed toward the whites, but have as yet seen little of them in their country since 1830, when the trappers were so numerous. They were then much dreaded by these adventurers. The Crows are fine warriors; have plenty of horses, mainly derived from traffic with the Flatheads. They live generally in skin lodges, and number about 600 lodges, or 4,800 souls.

Minnetarres, or Gros Ventres. This is a small band of the Crow Nation, living in a village of dirt lodges, surrounded by a rude stockade, near Fort Berthold. They raise corn, beans, pumpkins, &c. They number now about 800 souls, but, from a variety of causes, are diminishing.

The Arricarees, or Rees, are a branch of the Pawnee Nation, from which they have become separated by the migration of the Dakotas, and by these latter they are both known by the same name—Pedanis.

The Rees live in a village near Fort Clark, in a manner exactly similar to the Gros Ventres, and number about 840 souls. Formerly they were numerous and powerful and occupied a large village at the mouth of Grand River. This was destroyed during the expedition under Colonel Leavenworth, sent there in 1825 or 1826 to chastise them for the attack on the trading party of General Ashley. The remains of dirt-lodge villages all along the Missouri attest how numerous the Indians of this tribe must have been before the invasion of their lands by the Dakotas.

The Mandans live in a village, six miles above Fort Clark, in the same manner as the Gros Ventres. They seem to be the last remnant of a distinct tribe from any of those around them. They have, through the agency of the small-pox, rapidly diminished since they were visited by Lewis and Clark, and now number about 250 souls. They live in constant dread of the diseases which white men have been at times introducing among them, and the main and oft-repeated request which they made to the Indian agent when I was there in July, 1856, was that he would keep sick white men away. When I returned there in September, and saw them again a victim of that scourge, the small-pox, brought among them that year by the steamboat of the rival company to the American Fur Company, and saw the despair depicted on every countenance, it made me feel heart-sick to think what wrongs these poor savages have suffered from the cupidity of my own race. The authors of this calamity, which visited all the tribes in this region, are fully exposed in the report of the Indian agent, Colonel Vaughan, in 1856-'57.

Bear's Rib, the Unkpapa, gave me the following list of persons that died of this disease, from this cause, in 1856 and 1857, that he had heard of, though the disease was still at its work of death in some parts of the Crow country:

	Persons.
Rees	166
Hobés	1, 500
Big Head's band of Ihantonwans	30
Sihasapas	136

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It would be safe to assume the following as probable deaths in tribes not included in this list:

Gros Ventres and Mandans	160
Absarakos	1,000

1,160

Making a total of at least 3,000 souls.

Before such blows as this the red race would soon disappear; no war could be so fatal to them. The Government should, by all that is humane, employ some competent person, at a proper salary, to visit them yearly and vaccinate these Indians, and thus arrest the violence of these scourges.

These three little bands, the Gros Ventres, Mandans, and Rees, are fast dwindling away. They never can work much harm to the whites, and their mode of life at a fixed abode requires them to be peaceful. They exist now rather by sufferance of the Dakotas than by their own power, for the Dakotas could soon destroy them if they chose, as they did the villages of the Pawnees, on the Loup Fork, in about the year 1836. The Dakotas find it convenient for themselves to permit the existence of these villages, as their produce of corn, &c., forms a valuable commodity of trade between them.

The Ponkas are the small remnant of a once powerful tribe, and now live near the mouth of the Niobrara. They are on friendly terms with the Dakotas. The Government agents have lately effected a treaty with them by which a right to most of their lands has been purchased, and a reserve marked out for their location on the Niobrara and Ponka Rivers, near Fort Randall. The treaty has, I believe, not yet been ratified by the Senate. They number about ——— souls.

The Pawnees were formerly one of the most numerous and powerful and warlike of the Indians of the prairie. They have, through the agency of the small-pox and their constant wars with the Dakotas and Shyennes, been greatly reduced, and their numbers now do not probably exceed 4,000. They occupy the country on the Platte below Fort Kearney, and on Loup Fork. A treaty was made with them in the winter of 1857, by which they ceded a large portion of their lands to the United States, and agreed to retire to a reserve on the Loup Fork, where were their villages which were destroyed by the Dakotas. This treaty has not yet been ratified.

The Shyennes occupy the country between the Platte and Arkansas rivers, and number about ——— souls. These Indians have always been friends with the Dakotas, and associate much with them. During the summer of 1857, while the vigorous expedition conducted by Colonel Sumner was operating against them, a number to the amount of 40 lodges took refuge among the Dakotas, in the neighborhood of the Black Hills.

They will probably unite with the Dakotas in the event of any general war; though it is believed, from the great moral effect produced by the march of the Utah expedition through their common country, that they must see the futility of ever being able to contend against the power of the United States.

Of all the aborigines in the Territory under consideration, the Dakotas are probably the ones that have undergone the least material diminution of their numbers since their discovery by the whites. They are still numerous, independent, warlike, and powerful, and contain within them.

selves means of prolonged and able resistance to further encroachments of the western settlers. Under the present policy of Government, which there is no reason to believe will ever be changed, these encroachments will continue and new wars will result. I do not mean to say that a peaceable advance of the settlements westward might not be effected, but under the operation of present causes it will not. All of these conflicts end in the discomfiture of the native races, and they are fast melting away. It is not, as many suppose, that those dispossessed retire farther west; this they cannot do, for the region to the west of one tribe is generally occupied by another with whom deadly animosity exists. Hence, when the white settlements advance their frontier, the natives linger about till disease, poverty, and vicious indulgence consign them to oblivion. The present policy of the Government seems, therefore, the best calculated that could be devised for exterminating the Indian.

The advance of the settlements is universally acknowledged to be a necessity of our national development, and is justifiable in displacing the native races on that ground alone. But the Government, instead of being so constituted as to prepare the way for settlements by wise and just treaties of purchase from the present owners, and proper protection and support for the indigent race so dispossessed, is sometimes behind its obligations in these respects; and in some instances Congress refuses or delays to ratify the treaties made by the duly-authorized agents of the Government. The result is, that the settler and pioneer are precipitated into the Indian's country, without the Indian having received the just consideration promised him; and he often, in a manner that enlists the sympathies of all mankind, takes up the tomahawk in defense of his rights, and perishes in the attempt.

It is frequently the case that the settlers are unjustly charged with bringing about these wars, and, though I feel for the Indian, I cannot but sympathize with the pioneer, whose life is liable to be sacrificed to the Indian's vengeance.

The western settlers are now fighting the battle of civilization exactly as our forefathers did on the Atlantic shores, and under circumstances that command an equal amount of our admiration and approval.

We are in the habit of looking on the power of the United States as invincible, but it is far from being so regarded by the savages on our frontier. Many of them have never seen or felt it. There the Indians far outnumber the whites, and, if our sympathies must go with the weak, they should be with the settlers, who are only able, after all, to maintain their ground by the aid of the Army.

One of the chiefs of the Dakotas told me that they had a grand council in the summer of 1857, on the North Fork of the Shyenne, and that their hearts felt strong at seeing how numerous they were; that if they went to war again they would not yield so easy as they did before. At that council they solemnly pledged to each other not to permit further encroachments from the whites, and he fully believed they were able to whip all the white men in the world. In truth, they are not without reason in thinking so. They have never seen the whites except in small parties, stealing through their country, unable to resist them or protect themselves from insolence; or they find them shut up in little trading-posts, where for days they dare not, at times, open the gates or show their heads above the inclosure, and where, whenever a band of young warriors wish to have a frolic, they go and shoot their dogs, chickens, cattle, &c., break the windows, and commit any other outrage their fancy may suggest, as a diversion. They have seen the Indian agent, (their father, as he is called,) the direct representative of the President,

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insulted and abused with impunity by their own race, and sometimes in dread of losing his life, and they, many of them, entertain no respect for the power of our Government. Numbers of them have never seen a soldier of the United States Army, and scarce credit their existence.

Bear's Rib (a great friend to peace with the whites and the most influential warrior in his nation) said his people could not be controlled by him, and that if he should attempt it in some cases his own life would be the forfeit.

There are so many inevitable causes at work to produce a war with the Dakotas before many years, that I regard the greatest fruit of the explorations I have conducted to be the knowledge of the proper routes by which to invade their country and conquer them. The Black Hills is the great point in their territory at which to strike all the Teton Dakotas, except the Brulés and Okandandas. Here they can assemble their largest force, and here I believe they would make a stand. In the event of another outbreak, a post should be established at the mouth of the Shynenne, on the north side, from which to operate simultaneously with troops from Fort Laramie. From both of these points wagon-trains could move with ease, and supplies could without difficulty be sent thus to the troops in the field. These operations would undoubtedly bring on a battle, where the superiority of the weapons of civilized warfare would secure a victory to us. They will not, I think, permit the occupation of the vicinity of these hills without offering a determined resistance. Driven from these they must go north towards the Missouri, where a still better field to operate against them will be found, as this region is everywhere practicable. In this event it might become necessary to establish a temporary post above the Shynenne, and a most suitable and effective location is to be found near Long Lake, on the Missouri.

Those who may take refuge in the ravines and fastnesses along the Niobrara, or in the sand-hills, should be operated against from Forts Randall, Kearney, and Laramie. Should the Isanties and Ihanktonwannos be hostile at the same time as the Titonwans, they should be operated against from Fort Ridgeley.

It will be perceived that in this plan I have considered a war with all the Dakotas to be on our hands, which at no distant day is probable, and that there will be required a number of columns and a very large force to successfully operate over so much country. These columns need not exceed in any case a strength of 400 men, and these should be subdivided so as to beat up the country as much as possible, and endeavor to draw the Indians into an engagement where they may have some hope of success. With proper troops and commanders we need not even then fear the result.

The movement of large compact columns is necessarily slow, and they can easily be avoided, which the least military skill teaches the Indians to do. The war once begun should not be stopped till they are effectually humbled and made to feel the full power and force of the Government, which is a thing in which the Northern Dakotas are entirely wanting.

I believe a vigorous course of action would be quite as humane as any other, and much more economical and effectual in the end. With proper arrangements the Assiniboin and Crows and Pawnees could be made most useful allies in a war with the Dakotas. I see no reason why they should not be employed against each other, and thus spare the lives of the whites.

In giving my opinion of the best way of bringing the Dakotas to sub-

mission, in the event of a war, I think it my duty to state that I believe many of the causes of war with them might be removed by timely action in relation to the treaties, which are from time to time made with them, and a prompt and faithful fulfillment of our own part of the stipulations, and it is to be hoped that Congress will afford the means of carrying into effect the treaty made by General Harney in 1856, and those made by the Indian Bureau in 1857 with the Ihanktonwans and Poncas, and that it will provide liberally for those who have been dispossessed of their lands or impoverished by having their game driven off by the approach of the whites.

I have always found the Dakotas exceedingly reasonable beings, with a very proper appreciation of what are their own rights. What they yield to the whites they expect to be paid for, and I never have heard a prominent man of their nation express an opinion in regard to what was due them in which I do not concur. Many of them view the extinction of their race as an inevitable result of the operation of present causes, and do so with all the feelings of despair with which we should contemplate the extinction of our nationality.

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MEDICAL REPORT.

BY DR. SAMUEL H. MOFFITT.

WASHINGTON, D. C., *January 31, 1858.*

SIR: I submit a report of the most important cases of sickness that required medical treatment in the party under your command, from June 15 until December 4, 1857.

After the party reached the Loup Fork it was necessary to remain in camp for a number of days awaiting the arrival of the escort. The mouth of that stream was reached July 4, and we encamped near the river not far from the town of Columbus. It was in this locality that the most serious cases of illness which occurred in the party were generated. In passing up the Platte we traveled principally at some distance from the stream. Near the river, and along some of its tributaries, swampy districts of country exist which might endanger the health of persons living in their vicinity during the summer and autumn. I noticed long marshy tracts of this kind overgrown with heavy vegetation along the Loup Fork at this point. Soon after our encampment a good deal of bilious derangement prevailed in the party, and the presence of miasmatic poisons was soon made apparent in the occurrence of a number of cases of intermittent fever. Nearly all of the party experienced unpleasant disturbances of health here. The season had been unusually wet and the heat was extreme. Vegetation was consequently developed very rapidly, and it was, therefore, not difficult to account for the early appearance of disease among us. Under ordinary circumstances I would consider this region as healthy as most prairies, but the past seasons were particularly favorable to the development of malaria. All of the cases, however, that were treated here yielded readily, and when we commenced our journey up the Loup Fork no complaint was heard.

We seemed, however, peculiarly unfortunate in the start; for, a few days after we had got finally under way, the most serious case of sickness which we had to encounter during the trip commenced. On July 23, May, a teamster, exhibited the symptoms of fever, and it soon became apparent that this man must suffer a long and severe illness; under the most favorable circumstances his chances for recovery would have been considered few, and the circumstances under which we were of necessity placed tended greatly to diminish those chances. Delay was out of the question, as his case, if it resulted favorably, would require at least a fortnight, and we therefore placed him in the best situation that was possible in traveling, and did all in our power to promote his recovery. This case was an interesting one to the medical practitioner; it was one of those in which the signs and symptoms of typhoid and of remittent bilious fevers were intimately blended. Delirium commenced early, with stupor, diarrhea, and that peculiar condition of the tongue and mouth noticed in typhoid fever; with these some of the common symptoms of remittent fever were exhibited, and although the attack could not be cut short by quinia, its violence was greatly modified by that agent. The sickness of this man embarrassed our progress seriously, but after nearly three weeks of trouble and anxiety with his case we were gratified to note his convalescence. A

halt of three days during the most excited period of his disease tended greatly to promote a favorable termination. May was hauled the entire distance to Fort Laramie, not being able to perform any duty until we reached that point. On the 8th of August I was attacked with bilious remittent fever myself, and can testify from experience to the inconvenience from being sick on the prairies. My attack was not severe, and yielded in eight or ten days. These and the cases of intermittent were the only cases of fever that occurred in the party during the season.

The country through which we passed, up to this point, was along the Loup Fork. That portion of it most favorable to the production of fever is near its mouth. As you approach the sources of the river there are fewer wet tracts near the stream, and the country generally is not so flat. I notice the marshes particularly, as that is the only condition observed which could interfere with the health of the population if the country were inhabited. These are not numerous after you leave the mouth of the river some distance, and there is nothing to warrant the inference that the country is not highly favorable to health.

Indeed, in most respects, this region, so far as health is concerned, may be considered as highly favored. As you approach the elevated regions near the mountains, the atmosphere is exceedingly dry and pure. Much has been said of the favorable effects of a residence in this region upon persons laboring under pulmonary diseases. As this far-western region becomes more generally known, I think the subject will attract greater attention. I think the rational explanation of the improvement in consumptive cases that has been noted in this quarter is found in the dryness of the atmosphere. Sudden changes of temperature here, if not less frequent than in some of our Eastern States, are certainly not productive of the same bad consequences to the invalid. The lungs of those who are suffering with phthisis are here free from that constant irritation to which they are subjected in an atmosphere loaded with moisture; and the feeling of buoyancy and strength that is imparted encourages the invalid to make new exertions to promote recovery. A residence in such an atmosphere, combined with habits of active exercise, and constant living in the open air, might, in some cases I am sure, be productive of the best results. An intelligent friend, now residing at Fort Laramie, informed me that in his youth he was attacked with phthisis, that horrible disease being hereditary in his family. He was rapidly declining, and went to this far-western region in hope that the climate might prove beneficial. He made his home among the wandering bands of Indians, and avoided none of the exposure incident to such a life. He lay constantly in the open air, and took as much exercise as possible. His health improved, and in a year or two he was entirely restored, and is now residing at Fort Laramie a strong and healthy man. I have heard of many other cases similarly restored. In New Mexico consumption is unknown, I am informed, as a disease originating in the country, where the climate has the additional advantage of being warm.

During the extremely hot weather that continued during our journey up the Loup Fork, our party suffered very little with diarrhea or dysentery. A number of cases of the former occurred, but only a few required any treatment, and but a single case of dysentery, which was mild. After reaching Fort Laramie, those who had been sick rapidly recovered, and when we left that post all of the party were in excellent health.

During the fine weather that continued for a few weeks in the beginning of the fall no cases of sickness occurred. In October the weather

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became inclement, and was very cold and wet. During our trip down the Niobrara no complaint was heard, except in some chronic cases, which were somewhat aggravated by the bad weather and exposure, and when the party reached Fort Randall all were in good health. Several of the soldiers had suffered from scurvy during the summer; these improved during the trip down the Niobrara, along which stream we found an abundance of plums and grapes. After leaving Fort Randall, (November 7,) the members of the party were attacked with influenza, and this disease prevailed during the entire trip from Randall to Leavenworth, and only four or five members of the party escaped an attack. Some of the men, who were much exposed to the inclement weather that we experienced on the trip, suffered severely, and at times a sufficient number were not off of the sick-list to carry on the train property. All recovered, however, and when we reached Leavenworth the party was in good health. Below is an enumeration of the most important cases treated during the season. Many trifling cases occurred of which no note was taken.

Diseases.	No. cases.	Results.
Intermittent fever.....	5	Recovered.
Bilious remittent.....	2	Recovered.
Diarrhea.....	5	Recovered.
Dysentery.....	1	Recovered.
Gonorrhea, acute.....	3	Recovered.
Orchites.....	1	Recovered.
Gleet.....	3	Recovered.
Chronic cystitis.....	1	Recovered.
Diabetes.....	1	Improved.
Granular conjunctivitis.....	1	Improved.
Tarsal ophthalmia.....	1	Recovered.
Influenza.....	11	Recovered.

Respectfully,

Lieut. G. K. WARREN,
Topographical Engineers.

SAMUEL H. MOFFITT,
Physician to Expedition.